GRT INSTITUTE OF ENGINEERING AND TECHNOLOGY, Tiruttani

APPROVED BY AICTE- NEW DELHI, AFFILIATED TO ANNA UNIVERSITY – CHENNAI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

IV Year – 8th Semester

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REGULATION - 2013

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TOTAL: 45 PERIODS

TEXT BOOKS:
1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013. (UNIT I,II,III,IV).
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002. (UNIT V).

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2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
3. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication in Public World", PHI 2002.
6. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
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UNIT I – INTRODUCTION AND NUMBER THEORY

1. Specify the four categories of security threads?
- Interruption
- Interception
- Modification
- Fabrication

2. Explain active and passive attack with example?

Passive attack:

Monitoring the message during transmission.

Eg: Interception

Active attack:

It involves the modification of data stream or creation of false data stream.

E.g.: Fabrication, Modification, and Interruption

3. Define integrity and nonrepudiation?

Integrity:

Service that ensures that only authorized person able to modify the message.

Nonrepudiation:

This service helps to prove that the person who denies the transaction is true or false.

4. Differentiate symmetric and asymmetric encryption?

Symmetric	Asymmetric
It is a form of cryptosystem in which encryption and decryption performed using the same key.	It is a form of cryptosystem in which encryption and decryption Performed using two keys.
Eg: DES, AES	Eg: RSA, ECC

5. Define cryptanalysis? What is the role of cryptanalyst?

It is a process of attempting to discover the key or plaintext or both. In other words, techniques used for deciphering a message without any knowledge of the enciphering details fall into the area of cryptanalysis. Cryptanalysis is what the layperson calls "breaking the code". The area of cryptography and cryptanalyisi together are called cryptology.

6. Compare stream cipher with block cipher with example.

Stream cipher:

Processes the input stream continuously and producing one element at a time. Example: caeser cipher.

Block cipher:

Processes the input one block of elements at a time producing an output block for each input block.

Example: DES.

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7. Define security mechanism

It is process that is designed to detect prevent, recover from a security attack. Example: Encryption algorithm, Digital signature, Authentication protocols.

8. Differentiate unconditionally secured and computationally secured

An Encryption algorithm is unconditionally secured means, the condition is if the cipher text generated by the encryption scheme doesn't contain enough information to determine corresponding plaintext.

Encryption is computationally secured means,
1. The cost of breaking the cipher exceed the value of enough information.
2. Time required to break the cipher exceed the useful lifetime of information.

9. Define steganography

Hiding the message into some cover media. It conceals the existence of a message. this is different from cryptography, which hides the meaning of a message but does not hide the message itself.

10. List out the types of attacks on encrypted messages.
1. Ciphertext only
2. Known plaintext
3. Chosen Plaintext
4. Chosen Ciphertext
5. Chosen text

11. Define Encryption and Specify the components of encryption algorithm.

The process of converting from plaintext to cipher text.
1. Plaintext
2. Encryption algorithm
3. secret key
4. ciphertext
5. Decryption algorithm

12. Define confidentiality and authentication
Confidentiality:
It means how to maintain the secrecy of message. It ensures that the information in a computer system and transmitted information are accessible only for reading by authorized person.
Authentication

It helps to prove that the source entity only has involved the transaction.

13. Define cryptography.

It is a science of writing Secret code using mathematical techniques. The many schemes used for enciphering constitute the area of study known as cryptography.

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14. Compare Substitution and Transposition techniques.

SUBSTITUTION	TRANSPOSITION
*A substitution techniques is one in which the letters of plaintext are replaced by other letter or by number or symbols. *Eg: Caeser cipher.	* It means, different kind of mapping is achieved by performing some sort of permutation on the plaintext letters. *Eg: DES, AES.

15. Define Diffusion & confusion.
Diffusion:
It means each plaintext digits affect the values of many ciphertext digits which is equivalent to each ciphertext digit is affected by many plaintext digits. It can be achieved by performing permutation on the data. It is the relationship between the plaintext and ciphertext.
Confusion: It can be achieved by substitution algorithm is the relationship between ciphertext and key.

16. Define Product cipher.
It means two or more basic cipher are combined and it produce the resultant cipher is called the product cipher.

17. Define Avalanche effect.
A desirable property of any encryption algorithm is that a small change in either the plaintext or the key produce a significant change in the ciphertext. In particular, a change in one bit of the plaintext or one bit of the key should produce a change in many bits of the ciphertext. If the change is small, this might provider a way to reduce the size of the plaintext or key space to be searched.

18. What are the different Substitution Techniques are available?
1. Caesar Cipher
2. Monoalphabetic Cipher
3. Playfair Cipher
4. Hill Cipher
5. Polyalphabetic Substitution
6. One Time Pad
7. Feistel Cipher

19. What are the design parameters of Feistal Cipher network?
*Block size
*Key size
*Number of Rounds
*Subkey generation algorithm
*Round function
*Fast software Encryption/Decryption
*Ease of analysis

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20. Define Discrete Logarithms.

Discrete logarithms are fundamental to a number of public key algorithms, including Diffie-Hellman key exchange and DSA.

21. Define Euler's theorem and it's application?

Euler's theorem states that for every a and n that qi-t relatively prime:

$$a^{\phi(n)} = 1 \bmod n$$

22. Define Euler's totient function or phi function and their applications?

The Euler's totient function states that it should be clear for a prime number p,

$$\phi(p) = p\text{-}1$$

23. Describe in general terms an efficient procedure for picking a prime number?

The procedure for picking a prime number is as follows:
1. Pick an odd integer n at random (eg., using a pseudorandom number generator).
2. Pick an integer a<n at random.
3. Perform the probabilistic primality test, such as Miller-Rabin. If n fails the test, reject the value n and go to step 1.
4. If n has passed a sufficient number of tests, accept n; otherwise , go to step 2.

24. Define Fermat Theorem?

Fermat Theorem states the following: If p is prime and a is a positive integer not divisible by p, then

$$A^{P\text{-}1} = 1 \bmod p$$

25. Find gcd (1970, 1066) using Euclid's algorithm?

gcd (1970,1066) = gcd(1066,1970 irui 1)66)
= gcd(1066,904)
=2

UNIT II – BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY

1. Give the five modes of operation of Block cipher.
1. Electronic Codebook(ECB)
2. Cipher Block Chaining(CBC)
3. Cipher Feedback(CFB)
4. Output Feedback(OFB)
5. Counter(CTR)

2. State advantages of counter mode.
*Hardware Efficiency
*Software Efficiency
*Preprocessing
*Random Access
* Provable Security

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*Simplicity.

3. Specify the design criteria of block cipher.
Number of rounds
Design of the function F
Key scheduling

4. Define Reversible mapping.
Each plain text is maps with the unique cipher text. This transformation is called reversible mapping.

5. Specify the basic task for defining a security service.
A service that enhances the security of the data processing systems and the information transfer of an organization. The services are intended to counter security attack, and they make use of one or more security mechanism to provide the service.

6. What is traffic Padding? What is its purpose?
Traffic padding produces ciphertext output continuously, even in the absence of the plain text. A continuous random data stream is generated. When plain text is available, it is encrypted and transmitted. When input plaintext is not present, random data are encrypted and transmitted. This makes it impossible to for an attacker to distinguish between true dataflow and padding and therefore impossible :o deduce the amount of traffic.

7. List the evaluation criteria defined by NIST for AES? The
Evaluation criteria for AES is as follows:
1. Security
2. Cost
3. Algorithm and implementation characteristics

8. What is Triple Encryption? How many keys are used in triple encryption?
Triple Encryption is a technique in which encryption algorithm is performed three times using three keys.

9. Differentiate public key and conventional encryption?
Conventional Encryption
1. The same algorithm with the same Key is used for encryption and decryption
2. The sender and receiver must share The algorithm and the key
3. The key must be secret
4. It must be impossible or atleast impractical decipher a message if no other information is available

Public key Encryption
1. One algorithm is used for encryption and decryption with a pair of keys, one for encryption and another for decryption
2. The sender and receiver must each have one of the Matched pair of keys
3. One of two keys must be kept Secret
4. It must be impossible or to at least impractical to decipher a message if no other information is available.

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5. Knowledge of the algorithm plus one of key plus samples of ciphertext must be insufficient to determine the other key.

10. What are the principle elements of a public key cryptosystem?

The principle elements of a cryptosystem are:

      1.plain text
      2.Encryptionalgoritm
      3.Public and private key
      4.Cipher text
      5.Decryption algorithm

11. What are roles of public and private key?

    The two keys used for public-key encryption are referred to as the public key and the private key. Invariably, the private key is kept secret and the public key is known publicly. Usually the public key is used for encryption purpose and the private key is used in the decryption side.

12. Specify the applications of the public key cryptosystem?

    The applications of the public-key cryptosystem can classified as follows

1. Encryption/Decryption: The sender encrypts a message with the recipient's public key.
2. Digital signature: The sender "signs" a message with its private key. Signing is achieved by a cryptographic algorithm applied to a message or to a small block of data that is a function of the message.
3. Key Exchange: Two sides cooperate to exchange a session key. Several different approaches are possible, involving the private key(s) of one or both parties.

13. What requirements must a public key cryptosystem to fulfill to a secured algorithm?

    The requirements of public-key cryptosystem are as follows:

1. It is computationally easy for a party **B** to generate a pair(Public key KUb, Private key KRb)
2. It is computationally easy for a sender A, knowing the public key and the message to be encrypted , M, to generate the corresponding ciphertext:
$$C=EKUb(M)$$
3. It is computationally easy for the receiver **B** to decrypt the resulting ciphertextusing the private key to recover the original message :
$$M=DKRb(C)=Dium[Exub(M)]$$
4. It is computationally infeasible for an opponent , knowing the public key,KUb,todetermine the private key,KRb.
5. It is computationally infeasible for an opponent , knowing the public key,KUb, and a ciphertext, C, to recover the original message,M.
6. The encryption and decryption functions can be applied in either order:
$$M=EKub [DxRb(M)]=Dxub [ExRb(M)]$$

14. What is a one way function?

    One way function is one that map the domain into a range such that every function value has a unique inverse with a condition that the calculation of the function is easy where as the calculations of the inverse is infeasible.

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15. What is a trapdoor one way function?

It is function which is easy to calculate in one direction and infeasible to calculate in other direction in the other direction unless certain additional information is known. With the additional information the inverse can be calculated in polynomial time. It can be summarized as: A trapdoor one way function is a family of invertible functions fk, such that

$$Y= fk(X) \quad \text{easy, if k and X are known}$$
$$X=fk^{-1}(Y) \quad \text{easy, if k and y are known}$$
$$X= f_k^{-1}(Y) \quad \text{infeasible, if Y is known but. k is not known}$$

16. List four general characteristics of schema for the distribution of the public key?

The four general characteristics for the distribution of the public key are

1. Public announcement
2. Publicly available directory
3. Public-key authority
4. Public-key certificate

17. What is a public key certificate?

The public key certificate is that used by participants to exchange keys without contacting a public key authority, in a way that is as reliable as if the keys were obtained directly from the public-key authority. Each certificate contains a public key and other information, is created by a certificate authority, and is given to a participant with the matching private key.

18. What are essential ingredients of the public key directory?

The essential ingredient of the public key are as follows:

1. The authority maintains a directory with a {name, public key} entry for each participant

2. Each participant registers a public key with the directory authority. Registration would have to be in person or by some form of secure authenticated communication.

3. A participant may replace the existing key with a new one at a time ,either because of the desire to replace a public key that has already been used for a large amount of data, or because the corresponding private key has been comprised in some way.

4. Periodically, the authority publishes the entire directory or updates to the directory. For example, a hard-copy version much like a telephone book could be published, or updates could be listed in a widely circulated newspaper.

5. Participants could also access the directory electronically. Fui⁻ this purpose, secure, authenticated communication from the authority to the participant is mandatory.

19. What is the primitive root of a number?

We can define a primitive root of a number p as one whose powers generate all the integers from 1 to p-1. That is p, if a is a primitive root of the prime number p then the numbers.

20. Perform encryption and decryption using RSA Alg. for the following.
P=7; q=11; e=17; M=8.
Soln:

n = pq
n = 7*11=77

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ii)(n)=(p-1) (q-1)
       =6*10 = 60
e =17
d =27
C= M^e mod n
C = 817 mod 77
   = 57
M = C^d mod n
   = 5727 mod 77
   =8

21.What is an elliptic curve?

The principle attraction of ECC compared to RSA, is that it appears to offer equal security for a far smaller key size, thereby reducing processing overhead.

22. Give features and weakness of Diffie Hellman?

FEATURES:
- Secret keys created only when needed.
- Exchange requires no preexisting infrastructure.

WEAKNESS:
- Provide no information about identities.
- It is subjected to man in middle attack.

UNIT III – HASH FUNCTIONS AND DIGITAL SIGNATURES

1. What is message authentication?

It is a procedure that verifies whether the received message comes from assigned source has not been altered. It uses message authentication codes, hash algorithms to authenticate the message.

2. Define the classes of message authentication function.

- Message encryption: The entire cipher text would be used for authentication.
- Message Authentication Code: It is a function of message and secret key produce a fixed length value.
- Hash function: Some function that map a message of any length to fixed lengthwhich serves as authentication.

3. What are the requirements for message authentication?

The requirements for message authentication are

1. Disclosure: Release of message contents to any person or process not processing the appropriate cryptographic key

2. Traffic Analysis: Discovery of the pattern of traffic between parties. In a connection oriented application, the frequency and duration of connections could be determined. In either a connection oriented or connectionless environment, the number and length of messages between parties could be determined.

3. Masquerade: Insertion of messages into the network from a fraudulent source. This includes the creation of messages by an opponent that are purported to come from an authorized entity. Also included are fraudulent acknowledgements of message receipt or no receipt by someone other than the message recipient.

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4. Content modification: Changes to the contents of a message , including insertion, deletion, transposition, and modification.

5. Sequence modification: Any modification to a sequence of messages between parties, including insertion, deletion, and modification.

6. Timing modification: Delay or replay of messages. In a connection oriented application, an entire session or sequence of messages could be a replay of some previous valid session, or individual messages in the sequence could be delayed or replayed. In connectionless application, an individual message could be delayed or replayed.

7. Source repudiation: Denial of transmission of message by source.

8. Destination repudiation: Denial of receipt of message by destination.

4. What you meant by hash function?

Hash function accept a variable size message M as input and produces a fixed size hash code H(M) called as message digest as output. It the variation on the message authentication code.

5. Differentiate MAC and Hash function?

MAC: In Message Authentication Code, the secret key shared by sender and receiver. The MAC is appended to the message at the source at a time which the message is assumed or known to be correct.

Hash Function: The hash value is appended to the message at the source at time when the message is assumed or known to be correct. The hash function itself not considered to be secret.

6. Any three hash algorithms.

- MD5 (Message. Digest version 5) algorithm.
- SHA _1 (Sec ire Hash Algorithm).
- RIPEMD_160 algorithm.

7. What are the requirements of the hash function?

H can be applied to a block of data of any size.

H produces a fixed length output.

H(x) is relatively easy to compute for any given x, making both hardware and software implementations practical.

8. What you meant by MAC?

MAC is Message Authentication Code. It is a function of message and secret key which produce a fixed length value called as MAC.

$$MAC = Ck(M)$$

Where M = variable length message

K = secret key shared by sender and receiver.

$C_K(M)$ = fixed length authenticator.

9. Differentiate internal and external error control.

Internal error control:

In internal error control, an error detecting code also known as frame check sequence or checksum.

External error control:

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In external error control, error detecting codes are appended after encryption.

10. What is the meet in the middle attack?

This is the cryptanalytic attack that attempts to find the value in each of the range and domain of the composition of two functions such that the forward mapping of one through the first function is the same as the inverse image of the other through the second function-quite literally meeting in the middle of the composed function.

11. What is the role of compression function in hash function?

The hash algorithm involves repeated use of a compression function f, that takes two inputs and produce a n-bit output. At the start of hashing the chaining variable has an initial value that is specified as part of the algorithm. The final value of the chaining variable is the hash value usually b>n; hence the term compression.

12. What is the difference between weak and strong cohision resistance?

Weak collision resistance	Strong resistance collision
For any given block x, it is computationally infeasible to fine 34x with H(y)=H(x).	It is computationally infeasible to find any pair (x,y) such that H(x)=H(y)
It is proportional to 2^n	It is proportional to $2^{11/2}$

13. Compare MD5, SHA1 And RIPEMD-160 algorithm.

	MD5	SHA-1	RlPEMD160
Digest length	128 bits	160 bits	160 bits
Basic unit of processing	512 bits	512 bits	512 bits
No of steps	64(4 rounds of 16)	80 (4 rounds of 20)	160 (5 paired rounds of 16)
Maximum message	∞	2^{64}-1 bits	2^{64}-1 -1
Primitive logical function	4	4	5
Additive constants used	64	4	9
Endianess	Little Endian	Big Endian	Little Endian

14. Distinguish between direct and arbitrated digital signature?

Direct digital signature	Arbitrated Digital Signature
The direct digital signature involves only the communicating parties.	The arbiter plays a sensitive and crucial role in this digital signature.
This may be formed by encrypting the entire message with the sender's private key.	Every signed message from a sender x to a receiver y goes first to an arbiter A, who subjects the message and its signature to a number of tests to check its origin and content.

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15. What are the properties a digital signature should have?
- It must verify the author and the data and time of signature.
- It must authenticate the contents at the time of signature.
- It must be verifiable by third parties to resolve disputes.

16. **What requirements should a digital signature scheme should satisfy?**
- ❖ The signature must be bit pattern that der ei:(Is on the message being signed.
- ❖ The signature must use some information unique to the sender, to prevent both forgery and denial.
- ❖ It must be relatively easy to produce the digital signature.
- ❖ It must be relatively easy to recognize and verify the digital signature.
- ❖ It must be computationally infeasible to forge a digital signature, either by constructing a new message for an existing digital signature or by constructing a fraudulent digital signature for a given message.
- ❖ It must be practical to retain a copy of the digital signature in storage.

UNIT IV – SECURITY PRACTICE & SYSTEM SECURITY

1. Define Kerberos.
Kerberos is an authentication service developed as part of project Athena at MIT. The problem that Kerberos address is, assume an open distributed environment in which users at work stations wish to access services on servers distributed throughout the network.

2. What is Kerberos? What are the uses?
Kerberos is an authentication service developed as a part of project Athena at MIT.Kerberos provide a centralized authentication server whose functions is to authenticate servers.

3. What 4 requirements were defined by Kerberos?
- ■ Secure
- ■ Reliable
- ■ Transparent
- ■ Scalable

4. In the content of Kerberos, what is realm?
A full service Kerberos environment consisting of a Kerberos server, a no. of clients, no.of application server requires the following:
- ■ The Kerberos server must have user ID and hashed password of all participating users in its database.
- ■ The Kerberos server must share a secret key with each server. Such an environment is referred to as "Realm".

5. Assume the client C wants to communicate server S using Kerberos procedure. How can it be achieved?
Dialogue between client 'C' , server 'S' and authentication server(AS) are given below
- a) $C \longrightarrow AS: [ID_c \| P_c \| ID_s]$
- b) $AS \longrightarrow C:$ Ticket

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c) C $\longrightarrow$ S: [IDc ‖ ADc ‖ IDs]
   Ticket = **EKs** [IDc ‖ ADc ‖ IDs]

Step 1: The user logon to workstation and request access to the server S. The
client module C in the workstation request user password and sends message to AS that
includes user ID(IDc), server ID(IDc) and its password.
Step 2: Now the AS verify users password against its password database, if it is valid. AS
sends the ticket to C that includes user ID(IDc), server ID(IDs) and the address of the
client workstation (ADc) are encrypted with key which is shared by both AS and
server(S).
Step 3: Now the client use the ticket to sere :.,' S, to send the message to S with DX to
access service.

6. What is the purpose of X.509 standard?

X.509 defines framework for authentication services by the X.500 directory to its
users.X.509 defines authentication protocols based on public key certificates.

7. List the 3 classes of intruder?

Classes of Intruders
- Masquerader
- Misfeasor
- Clandestine user

8. Define virus. Specify the types of viruses?

A virus is a program that can infect other program by modifying them the
modification includes a copy of the virus program, which can then go on to infect other
program.
Types:
1) Parasitic virus
2) Memory-resident virus
3) Boot sector virus
4) Stealth virus
5) Polymorphic virus

9. What is application level gateway?

An application level gateway also called a proxy server; act as a relay of
application-level traffic. The user contacts the gateway using a TCP/IP application, such
as Telnet or FTP, and the gateway asks the user for the name of the remote host to be
accessed.

10. List the design goals of firewalls?

- All traffic from inside to outside, and vise versa, must pass through the firewall.
- Only authorized traffic, as defined by the local security policy, will be allowed to
  pass.
- The firewall itself is immune to penetration.

11. What you mean by Verisign certificate?

Mostly used issue X.509 certificate with the product name" Verisign digital id". Each digital id contains owner's public key, owner's name and serial number of the digital id.

12. What are the types of Firewall?
1. Packet filtering router
2. Application level gateways
3. Circuit level gateways

13. Define Worm.
Worm is a program that replicates itself by installing copies of itself on other machines across a network. for example, an email virus has some of its characteristics of s work because it propagates itself from system to system.

14. What are the ways we prevent the viruses?
1. Detection (determine and locate) virus
2. Identification of virus
3. Removal of traces of virus

15. Define Intrusion detection and Give the intrusion detection techniques.
It is the act of detecting unwanted traffic on a network or a device.
Intrusion detection techniques:
1. Threshold detection
2. Anomaly detection
3. Rule based detection

16. What is dual signature? What it is purpose?
The purpose of the dual signature is to link two messages that intended for two different recipients. To avoid misplacement of orders.

17. What are the participant of SET system?
- Card holder
- Merchant
- Issuer
- Acquirer
- Payment gateway
- Certification authority

18. What is logic bomb?
Logic embedded in a computer program that checks for a certain set of conditions to be present on the system. When these conditions are met, it executes some functioning that result in unauthorized actions.

19. What are the effects of malicious software? Write any two.

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The generic term for threats is malicious software or malware. Malware is software designed to cause damage to or use up the resource of a target computer.

Ex. Trap Door and Trojan Horse.

20. Give the characteristics of Macro Viruses.
- A macro virus is platform independent virtually all of the macro viruses infect MS Word documents.
- Macro viruses infect documents, not executable portions of code.
- Macro viruses are easily spread. A very common method is by electronic mail.

21. Define Zombie.

A zombie is a computer connected to the Internet that has been compromised by a hacker, computer virus or trojan horse program and can be used to perform malicious tasks of one sort or another under remote direction.

UNIT V – E-MAIL, IP & WEB SECURITY

1.What are the services provided by PGP services
- Digital signature
- Message encryption
- Compression
- E-mail compatibility
- Segmentation

2. Explain the reasons for using PGP?
a) It is available free worldwide in versions that run on a variety of platforms, including DOS/windows, UNIX, Macintosh and many more.
b) It is based on algorithms that have survived extensive public review and are considered extremely secure.
E.g.) RSA, DSS and Diffie-Hellman for public key encryption, CAST-128, IDEA, 3DES for conventional encryption, SHA-lfor hash coding.
c) It has a wide range of applicability from corporations that wish to select and enforce a standardized scheme for encrypting files and communication.
d) It was not developed by nor is it controlled by any governmental or standards organization.

3. Why E-mail compatibility function in PGP needed?
Electronic mail systems only permit the use of blocks consisting of ASCII text. To accommodate this restriction PGP provides the service converting the row 8-bit binary stream to a stream of printable ASCII characters. The scheme used for this purpose is Radix-64 conversion.

4. Name any cryptographic keys used in PGP?
a) One-time session conventional keys.
b) Public keys.

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c) Private keys.
d) Pass phrase based conventional keys.

5. Define key Identifier?

PGP assigns a key ID to each public key that is very high probability unique with a user **ID.** It is also required for the PGP digital signature. The key ID associated with each public key consists of its least significant 64bits.

6. List the limitations of SMTP/RFC 822?

a) SMTP cannot transmit executable files or binary objects.
b) It cannot transmit text data containing national language characters.
c) SMTP servers may reject mail message over certain size.
d) SMTP gateways cause problems while transmitting ASCII and EBCDIC.
e) SMTP gateways to X.400 E-mail network cannot handle non textual data included in X.400 messages.

7. Draw the diagram for PGP message transmission reception?
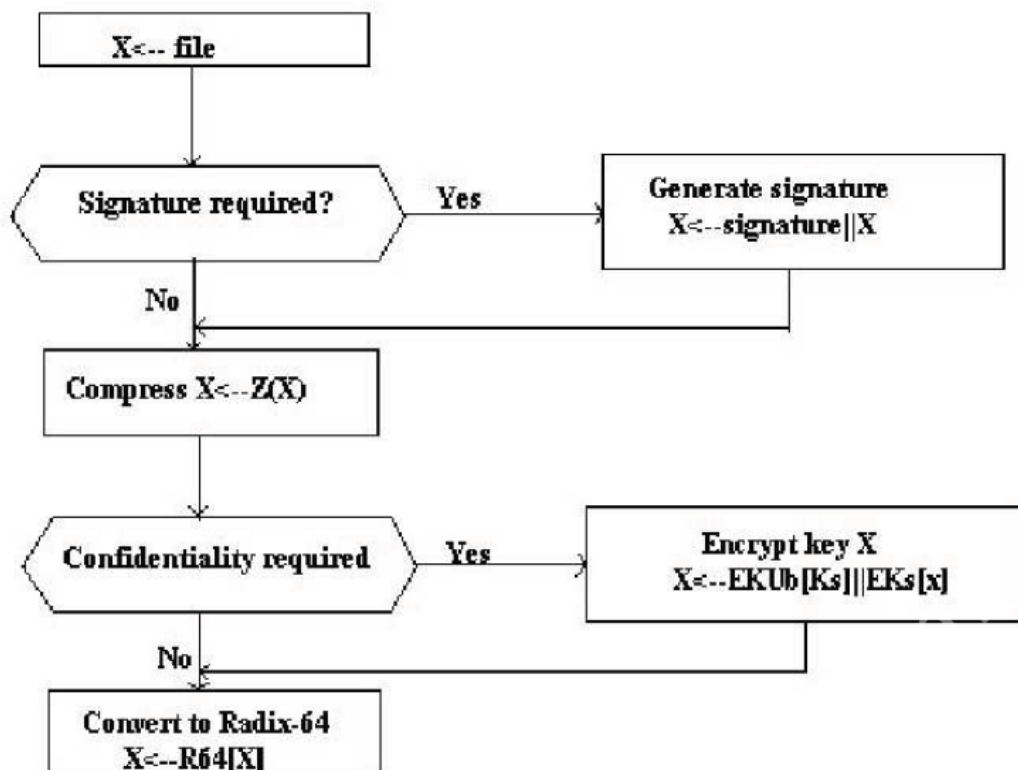
a)Transmission Diagram

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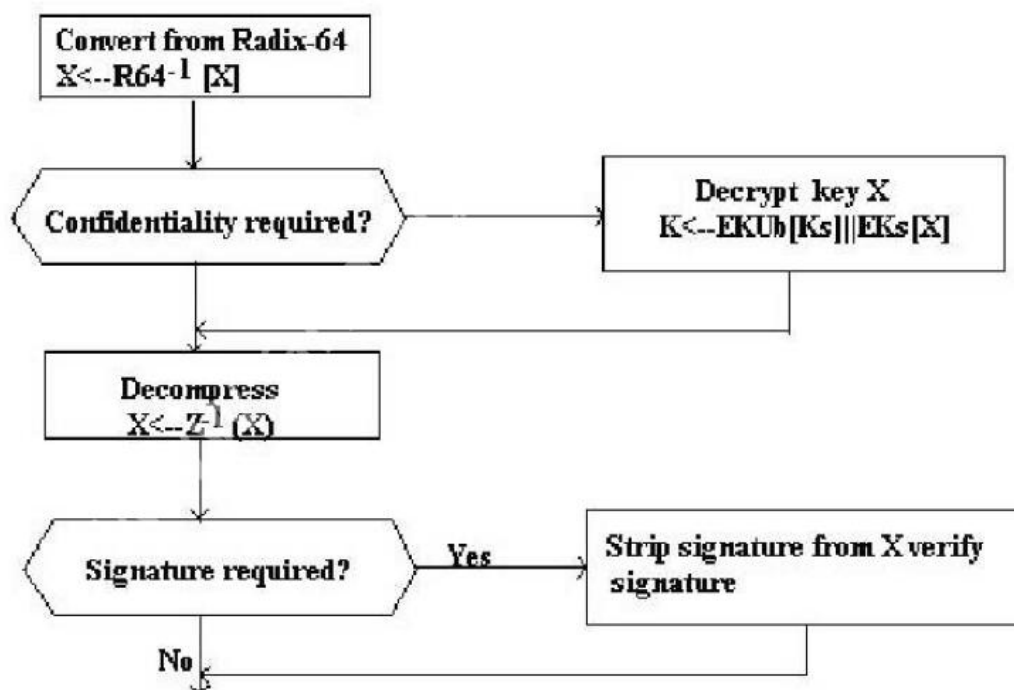
b) Reception Diagram

8. What is the general format for PGP message?
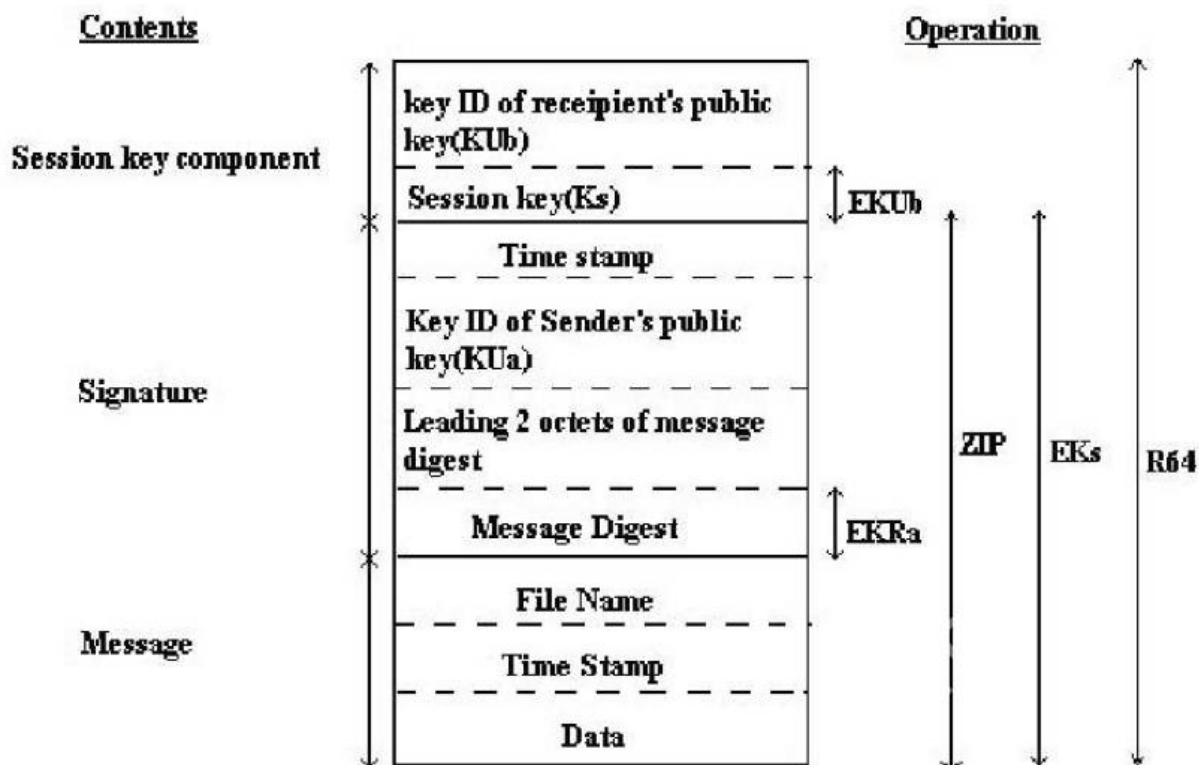
9. Define S/MIME?

Secure/Multipurpose Internet Mail Extension(S/MIME) is a security enhancement to the MIME Internet E-mail format standard, based on technology from RSA Data Security.

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10.   What are the elements of MIME?
- ✓ Five new message header fields are defined which may be included in an RFC 822 header.
- ✓ A number of content formats are defined.
- ✓ Transfer encodings are defined that enable the conversion of any content format into a form that is protected from alteration by the mail system.

11. What are the header's fields define in MIME?
- MIME version.
- Content type.
- Content transfer encoding.
- Content id.
- Content description.

12. Define Botnets.

A network of private computers infected with malicious software and controlled as a group without the owners' knowledge, e.g. to send spam.

13. What are the key algorithms used in S/MIME?
- Digital signature standards.
- Diffi Hellman.
- RSA algorithm.

14. Give the steps for preparing envelope data MIME?
- Generate K_s.
- Encrypt K_s using recipient's public key.
- RSA algorithm used for encryption.
- Prepare the 'recipient info block'.
- Encrypt the message using K_s.

15. What are the function areas of IP security?
- Authentication
- Confidentiality
- Key management.

16. Give the application of IP security?
- Provide secure communication across private & public LAN.
- Secure remote access over the Internet.
- Secure communication to other organization.

17. What do you mean by Security Association? Specify Parameters that identifies the Security Association?
- An association is a one-way relationship between a sender and receiver that affords security services to the traffic carried on.
- A key concept that appears in both the authentication and confidentiality mechanism for IP is the security association (SA).

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A security Association is uniquely identified by 3 parameters:
- Security Parameter Index (SPI).
- IP Destination Address.
- Security Protocol Identifier.

18. What does you mean by Reply Attack?
- A replay attack is one in which an attacker obtains a copy of an authenticated packet and later transmits it to the intended destination.
- Each time a packet is send the sequence number is incremented in the cc enter by the sender.

19. General format of IPsec ESP Format?

Security Parameter Index(SPI)
Sequence Number(SN)
Payload Data (Variable)
Padding(0-255 bytes)
Authentication Data (variable)

20. Differentiate Transport and Tunnel mode in IPsec?

Transport mode	Tunnel Mode
1. Provide the protection for upper layer protocol between two hosts.	1. Provide the protection for entire IP Packet.
2. ESP in this mode encrypts and optionally authenticates IP Payload but not IP Header.	2. ESP in this mode encrypt the entire IP packet.
3. AH in this mode authenticate the IP Payload and selected portion of IP Header.	3. AH in this mode authenticate the entire IP Packet plus selected portion of outer IP Header.

21. What is Authentication Header? Give the format of the IPsec Authentication Header?

It provides the authentication of IP Packet, so authentication is based on the use of MAC.

Format of IPsec Authentication Header:

First Header	Payload Length	Reserved
Security Parameter Index(SPI)		
Sequence number(SN)		
Authentication Data(Variable)		

22. Define Transport Adjacency and Iterated Tunnel?
Transport Adjacency:

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Apply authentication after encryption, two bundle transport mode Security Association
- o Inner SA (ESP_SA)
- o Outer SA(AH_SA)

Iterated Tunnel:

Apply authentication before encryption, 2 SA are combined,
- o Inner Sa-AH transport mode.
- o Outer Sa-ESP Tunnel mode.

23. Explain the format of ESP Transport Mode?

Authenticated

Encrypted

Orig IPhdr	ESP hdr	TCP	DATA	ESP Trir	ESP auth

Fig: IPV4

Authenticated

Encrypted

Orig IP hdr	Hop by hop,dest,routing,fragment	ESP hdr	dest	Tcp	Data	ESP trir	ESP auth
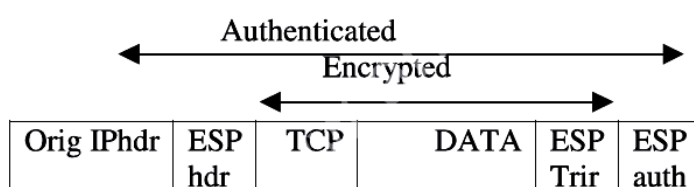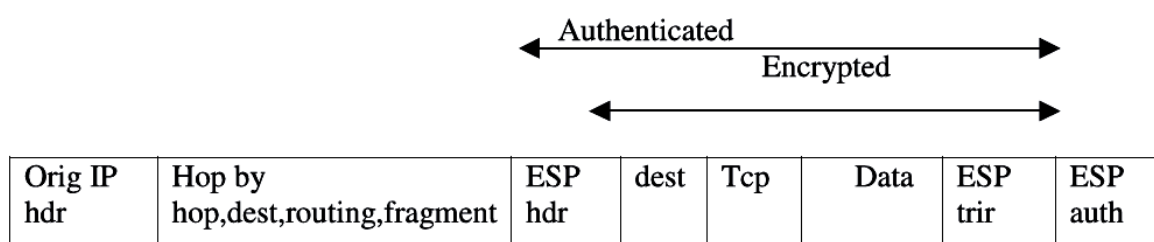
Fig:IPV6

24. List the steps involved in SSL record protocol?
1. SSL record protocol takes application data as input and fragments it.
2. Apply lossless Compression algorithm.
3. Compute MAC for compressed data.
4. MAC and compression message is encrypted using conventional alg.

25. Give SSL record format?

Content type	Major Version	Minor Version	Compressed length
Plain Text(Optionally Compressed)			
MAC 0, 16 or 20 bytes.			

26. What are the different between SSL version 3 and TLS?

SSL	TLS
* In SSL the minor version is 0 and the major version is 3	* In TLS, the major version is 3 and the minor version is 1.
* SSL use HMAC alg., except that	* TLS makes use of the same alg.

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the padding bytes concatenation.
* SSL supports 12 various alert codes. * TLS supports all of the alert codes defined in
SSL3 with the exception of no _ certificate.

27. What is mean by SET? What are the features of SET?

Secure Electronic Transaction (SET) is an open encryption and security specification designed to protect credit card transaction on the internet.

Features are:

1. Confidentiality of information
2. Integrity of data
3. Cardholder account authentication
4. Merchant authentication

28. What are the steps involved in SET Transaction?

1 The customer opens an account
2. The customer receives a certificate
3. Merchants have their own certificate
4. The customer places an order.
5. The merchant is verified.
6. The order and payment are sent.
7. The merchant requests payment authorization.
8. The merchant confirm the order.
9. The merchant provides tte goods or services.
10. The merchant requeF is payment.

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PART – B

UNIT I – INTRODUCTION AND NUMBER THEORY

1. Explain OSI security architecture model with neat diagram.
2. Explain the Substitution encryption techniques in detail.
3. Write about any two classical crypto systems (substitution and transposition) with suitable examples.
4. State and derive:
    a. Fermat's theorem and find 3^{21} mod 11
    b. Euler's theorem to find gcd.
5. Explain any two classical ciphers and also describe their security limitations.
6. Describe Linear Feedback Shift Registers Sequences and Finite Fields with their application in cryptography.
7. State Chinese Remainder Theorem and find X for the given set of congruent equations using CRT. X=2 (mod 3); X=3 (mod 5); X=2 (mod 7).
8. Define Euclid's algorithm. Brief about the algorithm.

UNIT II – BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY

1. Explain Data Encryption Standard (DES) in detail.
2. Write down the Triple DES algorithm and explain with neat diagram.
3. Explain AES algorithm with all its round functions in detail.
4. Explain the RSA algorithm in detail. For the given values. trace the sequence of calculations in RSA. P=7, q=13, e=5 and M=10.
5. Demonstrate encryption and decryption for the RSA algorithm parameters: p = 3, q = 11, e = 7, d = ?, M 5.
6. Briefly explain Diffie-Hellman Key Exchange with one suitable example.
7. Users A and B use the Diffie-Hellman key exchange technique with a common prime q = 71 and a primitive root a=7. If user A has private key XA = 5, what is A's public key YA?

UNIT III – HASH FUNCTIONS AND DIGITAL SIGNATURES

1. Explain ElGamal public key cryptosystems with an example.
2. Explain Secure Hash in detail.
3. Explain Digital Signature Standard with necessary diagrams in detail.
4. Describe MD5 algorithm in detail. Compare its performance with SHA-1.
5. Explain about secure hash algorithm (SHA) in detail.
6. What are the properties of hashing function in cryptography?
7. Explain digital signaturing with ElGamal public key cryptosystem.
8. Explain the following hash functions:
    a. MAC
    b. HMAC
    c. CMAC

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UNIT IV – SECURITY PRACTICE & SYSTEM SECURITY

1. Explain Kerberos Version 4 in detail.
2. Elaborately explain Kerberos authentication mechanism with suitable diagrams.
3. Explain statistical anomaly detection and rule based intrusion detection.
4. Describe any two advanced anti-virus techniques in detail.
5. Discuss about X.509 authentication service in detail.
6. Write about virus and related threats in detail.
7. Write brief notes on the following :
     a. Classification of viruses
     b. Worm Counter measures.
8. Explain briefly about trusted system.
9. Write short notes on Firewalls and Viruses.
10. Explain the characteristics and types of firewalls.
11. Explain how SET is use for E-commerce for secure transactions.

UNIT V – E-MAIL, IP & WEB SECURITY

1. Explain Pretty Good Privacy in detail.
2. Explain Secure Socket Layer (SSL) in detail.
3. Explain about S/MIME in detail.
4. Discuss in detail about the IP and IPv6 security standards.
5. Explain the various Internet Key Exchange schemes.
6. Write short notes about Web security and SET.
7. Explain about the PKI.

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Reg. No. :

Question Paper Code : 80304

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Seventh Semester

Computer Science and Engineering

CS 6701 — CRYPTOGRAPHY AND NETWORK SECURITY

(Common to Seventh Semester Information Technology)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compare active and passive attack.

2. Find gcd (1970, 1066) using Euclid's algorithm.

3. Brief the strengths of triple DES.

4. What is an elliptic curve?

5. State any three requirements for authentication.

6. Differentiate MAC and Hash function.

7. List the three classes of intruders.

8. Define Zombie.

9. List the limitations of SMTP/RFC 822.

10. Define Botnets.   www.recentquestionpaper.com

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain OSI Security Architecture model with neat diagram.   (8)
        (ii) Describe the various security mechanisms.   (8)

Or

    (b) (i) State Chinese Remainder theorem and find X for the given set of congruent equations using CRT.
            $X = 2 \pmod 3$
            $X = 3 \pmod 5$
            $X = 2 \pmod 7$.   (8)
        (ii) State and prove Fermat's theorem.   (8)

12. (a) Explain AES algorithm with all its round functions in detail. (16)

Or

(b) Explain RSA algorithm, perform encryption and decryption to the system with $p = 7$; $q = 11$; $e = 17$; $M = 8$. (16)

13. (a) Describe MD5 algorithm in detail. Compare its performance with SHA-1. (16)

Or

(b) Explain digital signature standard with necessary diagrams in detail. (16)

14. (a) Discuss Client Server Mutual authentication, with example flow diagram. (16)

Or

(b) Explain the technical details of firewall and describe any three types of firewall with neat diagram. (16)

15. (a) Discuss the working of SET with neat diagram. (16)

Or

(b) Explain the operational description of PGP. l6)

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Reg. No. :

Question Paper Code : 71763

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Seventh Semester

Computer Science and Engineering

IT 2352/IT 62/10144 IT 603/10144 CSE 46 — CRYPTOGRAPHY AND NETWORK SECURITY

(Common to Sixth Semester – Information Technology)

(Regulation 2008/2010)

(Common to PTIT 2352 – Cryptography and Network Security for B.E. (Part-Time) Seventh Semester – Computer Science and Engineering – Regulation 2009)

Time : Three hours   Maximum : 100 marks

(Codes/Tables/Charts to be permitted, if any, may be indicated)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between active attacks and passive attacks.

2. Find $11^7 \bmod 13$.

3. Differentiate between stream ciphers and block ciphers.

4. State few applications of RC4 algorithm.

5. What is primitive root?

6. What is digital Signature?

7. When are the certificates revoked in X.509?

8. What is tunnel mode in IP Security?

9. Define Worm.

10. What is the advantage of Intrusion detection system over firewall?

CS6701 CRYPTOGRAPHY AND NETWORK SECURITY

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

PART B — (5 × 16 = 80 marks)

11. (a) Explain the Substitution encryption techniques in detail. (16)

Or

(b) State and derive

   (i) Fermat's theorem (8)

   (ii) Euler's theorem. (8)

12. (a) Explain Data Encryption Standard (DES) in detail. (16)

Or

(b) Explain the RSA algorithm in detail. For the given values. trace the sequence of calculations in RSA. P=7, q=13, e=5 and M=10. (16)

13. (a) Explain ElGamal public key cryptosystems with an example (16)

Or

(b) Explain Secure Hash in detail. (16)

14. (a) Explain Kerberos Version 4 in detail. (16)

Or

(b) Explain Secure Socket Layer (SSL) in detail. (16)

15. (a) Write brief notes on the following :

   (i) Classification of viruses (8)

   (ii) Worm Counter measures. (8)

Or

(b) Explain the characteristics and types of firewalls. (16)

CS6701 CRYPTOGRAPHY AND NETWORK SECURITY

GRT INSTITUTE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Seventh Semester

Computer Science and Engineering

IT 2352/IT 62/10144 IT 603/10144 CSE 46 — CRYPTOGRAPHY AND NETWORK SECURITY

(Common to Sixth Semester – Information Technology)

(Regulation 2008/2010)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are active and passive attacks that compromise information security?

2. Why random numbers are used in network security?

3. State Euler's theorem.

4. What is Optimal Asymmetric Encryption Padding?

5. What is discrete logarithm problem?

6. State whether symmetric and asymmetric cryptographic algorithms need Key Exchange.

7. List the authentication requirements.

8. What are birthday attacks?

9. Differentiate spyware and virus.

10. What are zombies?

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

PART B — (5 × 16 = 80 marks)

(a) Explain any two classical ciphers and also describe their security limitations.

Or

(b) Describe Linear Feedback Shift Registers Sequences and Finite Fields with their application in cryptography.

(a) Describe the working principle of Simple DES with an example.

Or

(b) (i) Explain RSA algorithm. (8)

   (ii) Demonstrate encryption and decryption for the RSA algorithm parameters: $p = 3$, $q = 11$, $e = 7$, $d = ?$, $M = 5$. (8)

(a) Explain Digital Signature Standard.

Or

(b) (i) Briefly explain Diffie-Hellman Key Exchange. (8)

   (ii) Users A and B use the Diffie-Hellman key exchange technique with a common prime $q = 71$ and a primitive root $\alpha = 7$. If user A has private key $X_A = 5$, what is A's public key Y_A? (8)

(a) Elaborately explain Kerberos authentication mechanism with suitable diagrams.

Or

(b) Explain Pretty Good Privacy in detail.

(a) Explain statistical anomaly detection and rule based intrusion detection.

Or

(b) Describe any two advanced anti-virus techniques in detail.

CS6701 CRYPTOGRAPHY AND NETWORK SECURITY

GRT INSTITUTE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Question Paper Code : 21513

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Seventh Semester

Computer Science and Engineering

IT 2352/IT 62/10144 IT 603 – CRYPTOGRAPHY AND NETWORK SECURITY

(Common to Information Technology – Sixth Semester)

(Regulation 2008 / 2010)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Convert the given text "anna university" into cipher text using rail fence technique.

2. Define steganography.

3. What is the disadvantages with ECB mode of operation?

4. Find GCD (21,300) using Euclid's algorthim.

5. Define discrete logarithm.

6. What is weak collision resistance? What is the use of it?

7. List out the services provided by PGP.

8. Expand and define SPI.

9. Mention the two levels of hackers.

10. What is logic bomb?

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

PART B — (5 × 16 = 80 marks)

11. (a) Write about any two classical crypto systems (substitution and transposition) with suitable examples.

Or

(b) Write about Fermat and Euler's theorem in detail.

12. (a) Explain briefly about DES in detail.

Or

(b) Explain about RSA with one suitable example.

13. (a) Explain about secure hash algorithm (SHA) in detail.

Or

(b) Explain about Diffie Hellman Key exchange algorithm with one suitable example.

14. (a) Discuss about X.509 authentication service in detail.

Or

(b) Explain about S/MIME in detail.

15. (a) Write about virus and related threats in detail.

Or

(b) Explain briefly about trusted system.

CS6701 CRYPTOGRAPHY AND NETWORK SECURITY

GRT INSTITUTE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Question Paper Code : **31513**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Seventh Semester

Computer Science and Engineering

IT 2352/IT 62/10144 IT 603/10144 CSE 46 – CRYPTOGRAPHY AND NETWORK SECURITY

(Common to Sixth Semester – Information Technology)

(Regulation 2008/2010)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Give an example each for substitution and transposition ciphers.

2.   Why modular arithmetic has been used in cryptography?

3.   What are the modes of DES?

4.   List the uses of RC4.

5.   Write any two differences between MD4 and secure hash algorithm.

6.   How digital signature is different from conventional? Give any two.

7.   Define : SET.

8.   What do you mean by PGP?

9.   What are the effects of malicious software? Write any two.

10. What is 'Worm'?

PART B — (5 × 16 = 80 marks)

11. (a) (i)   What are the different types of attacks? Explain.   (8)

          (ii) State and explain Chinese remainder theorem with example.   (8)

Or

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(b) (i) State Fermat's theorem. (4)

(ii) Find 3^{21} mod 11 using Fermat's theorem. (6)

(iii) State Euler's theorem to find gcd with example. (6)

12. (a) Write down the Triple DES algorithm and explain with neat diagram.

Or

(b) Explain about the RSA algorithm with example as :

$p = 11$, $q = 5$, $e = 3$ and $PT = 9$.

13. (a) (i) Define a hashing function. (2)

(ii) What are the properties of hashing function in cryptography? (6)

(iii) Explain Secure Hashing Algorithm (SHA). (8)

Or

(b) (i) Illustrate about the Birthday attacks. (8)

(ii) Explain digital signaturing with ElGamal public key cryptosystem. (8)

14. (a) Write short notes about

(i) Web security (8)

(ii) SSL. (8)

Or

(b) Explain about the PKI.

15. (a) Explain about the Security standards.

Or

(b) Write short notes on

(i) Firewalls

(ii) Viruses.

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CS6702   **GRAPH THEORY AND APPLICATIONS**   **L T PC 3 0 0 3**
UNIT I   **INTRODUCTION**   **9**
Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits –Connectedness –Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

UNIT II   **TREES, CONNECTIVITY & PLANARITY**   **9**
Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planer graphs – Different representation of a planer graph.

UNIT III   **MATRICES, COLOURING AND DIRECTED GRAPH**   **8**
Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

UNIT IV   **PERMUTATIONS & COMBINATIONS**   **9**
Fundamental principles of counting – Permutations and combinations – Binomial theorem – combinations with repetition – Combinatorial numbers – Principle of inclusion and exclusion – Derangements – Arrangements with forbidden positions.

UNIT V   **GENERATING FUNCTIONS**   **10**
Generating functions – Partitions of integers – Exponential generating function – Summation operator – Recurrence relations – First order and second order – Non-homogeneous recurrence relations – Method of generating functions.

TOTAL: 45

PERIODS
TEXT BOOKS:
1. Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", Prentice   Hall   of   India,   2003.
2. Grimaldi R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley, 1994.
REFERENCES:
1. Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, 1995.
2. Mott J.L., Kandel A. and Baker T.P. "Discrete Mathematics for Computer Scientists and Mathematicians"   ,   Prentice   Hall   of   India,   1996.
3. Liu C.L., "Elements of Discrete Mathematics", Mc Graw Hill, 1985.
4. Rosen K.H., "Discrete Mathematics and Its Applications", Mc Graw Hill, 2007.

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Two mark Questions with Answers

UNIT I

1. **What is a Graph?**

   A linear graph (or simply a graph)$G = (V, E)$ consists of a set of objects V= {v_1, v_2...}
   called vertices, and another set E= {e_1, e_2...}, whose elements are called edges, such
   that each edge e_k is identified with an unordered pair (v_i, v_j) of vertices. The vertices
   v_i, v_j associated with are called the end vertices of e_k.

2. **Define Isomorphism**
   Two graph G and G' are said to be isomorphic if there is a one-to-one correspondence
   between their vertices and between their edges such that the incidence relationship is
   preserved.
   In other words, suppose that edge *e* is incident on vertices v_1 and v_2 in *G*; then the
   corresponding edge e' and G' must be incident on the vertices v_1' and v_2' that
   correspond to v_1 and v_2 respectively.
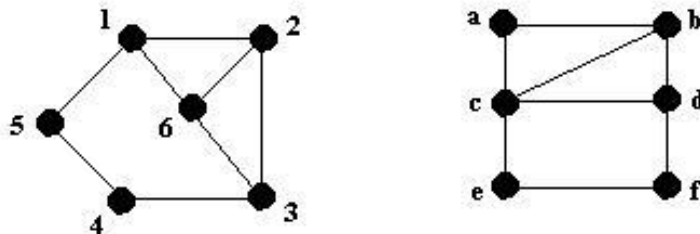
   Isomorphic graph

   Ie.,
   (i)The same no. of vertices
   (ii) The same no. of edges.
   (iii) An Equal no. of vertices with a given degree.

3. **Define Sub graph and give one example.**
   Ans: A graph H is said to be a subgraph of a graph G if all vertices and all the edges
   of H are in G, and each edge of H has the same end vertices in H as in G.
   The following observation can be made immediately
   (i)   Every graph is its own subgraph.
   (ii)   A single vertex in a graph H is a subgraph of G

4. **Define walk and give example.**
   A walk is defined as a finite alternating sequence of vertices and edges, beginning and
   ending with vertices, such that each edge is incident with the vertices preceding and
   following it. No edge appears more than once in a walk.
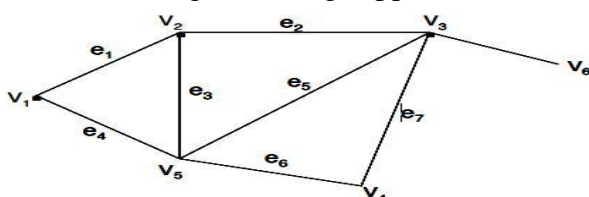
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A walk that begins and ends at the same vertex is called a **closed walk.** In other words, a **closed walk** is a walk in which the terminal vertices are coincident.
A walk which is not closed is called an **open walk**.
In other words, an **open walk** is a walk that begins and ends at two different vertices.

5. **Define Path and Cycle**
   A Path in a graph is a trial such that no internal vertex is repeated
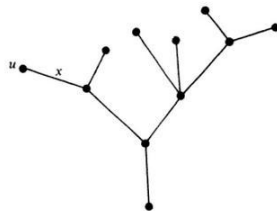   A Cycle is a closed path of length at least 1.

6. **Define Connected graph**
   A Graph G is said to be connected if there is at least one path between every pair of vertices in G. Otherwise, G is disconnected.

7. **Define Euler Graph**
   If some closed walk in a graph contains all the edges of the graph , then the walk is called an Euler line and the graph an Euler graph.

8. **Define Tree**

   A Tree is a connected graph with no cycles (ie., acyclic)

9. **Hamiltonian circuit**
   A Hamilton circuit in a connected graph is defined as a closed walk that traverses every vertex of G exactly once, except of course the starting vertex, at which the walk also terminates.
   In other words, A circuit in a connected graph G is said to be Hamiltonian if int includes every vertex of G. Hence a Hamiltonian circuit in a graph of n vertices consists of exactly n edges.

10. **Hamiltonian Path**
    If we remove any one edge from a Hamiltonian circuit, we are left with a path. This path is called a Hamiltonian path.

11. **Write down any five properties of Tree**
    (i)   There is one and only path between every pair of vertices in a tree, T
    (ii)   If in a graph G there is one and only one bath between every pair of vertices, G is a tree.
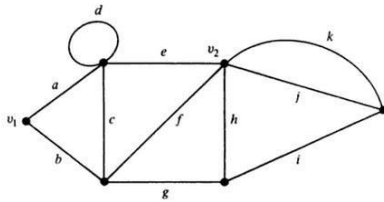   (iii)   A tree with n vertices has n – 1 edges.

12. **Define distance between two vertices**
    In a connected graph G, the distance d(vi, vj) between two of its vertices vi and vj is the length of the shortest path between them.

13.   **Define Metric**
    Before we can legitimately call a function f(x, y) of two variables a "distance" between them, this function must satisfy certain requirements.

There are
(i)   Non negativity: $f(x, y) \geq 0$, and $f(x, y)=0$ if and only if $x=y$
(ii) Symmetry: $f(x, y) = f(y, x)$.
(iii) Triangle inequality: $f(x, y) \leq f(x, z) + f(z, y)$ for any z.
          A function that satisfies these three conditions is called a metric.

14.   **Define Center**
The eccentricity $E(v)$ of a vertex v in a graph G is the distance from v to the vertex farthest from v in G; that is $\max_{v_i \in G} d(v, v_j)$. A vertex with minimum eccentricities in a graph G is called a center of G.

15.   **Define rooted**
A tree in which one vertex (called the root) is distinguished from all the others is called a rooted tree.

16.   **Define Binary Tree**
A binary Tree is defined as a tree in which there is exactly one vertex of degree two, and each of remaining vertices is of degree one or three.

17. **Define complement of a graph. Find an example of a** self-complementary **graph**

on four vertices and one on five vertices.

Every simple graph of order n is a subgraph of the complete graph Kn .If G is a simple graph of order n, then the complement of G in Kn is called the complement of G, it is denoted by G.
 Thus, the complement G of a simple graph G with n vertices is that graph which is obtained by deleting those edges of Kn which belongs to G. Thus G =Kn-G =KnΔG

UNIT II

1. **Define Spanning Tree**
A tree T is said to be a spanning tree of a connected graph G if T is a subgraph of G and T contains all vertices of G.

2. **Define Fundamental circuit**
A spanning tree T in a connected graph G. Adding any one chord to a spanning tree, is called a fundamental circuit.

3. **Define Weight of a spanning tree.**

The Weight of a spanning tree T of G is defined as the sum of the weights of all branches in T. In general, different spanning trees of G will have different weights.

4. Cut Set

A cut set of a connected graph G is a set S of edges with the following properties:

*   The removal of all edges in S disconnects G.
*   The removal of some (but not all) of edges in S does not disconnects G.

As an example consider the following graph
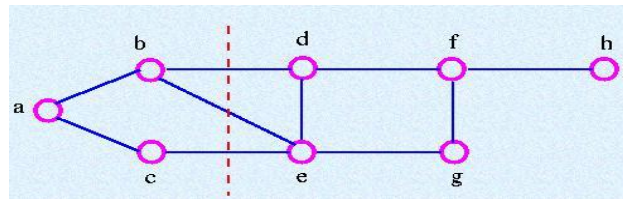
Example

We can disconnect G by removing the three edges bd, bc, and ce, but we cannot disconnect it by removing just two of these edges.

5. Properties of circuits and cut sets:

Every cut-set in a connected graph G must contain at least one branch of every spanning tree of G.

In a connected graph G, any minimal set of edges containing at least one branch of every spanning tree of G is a cut-set.

Every circuit has an even number of edges in common with any cut-set.

6. Define Fundamental Cut-set

Take any branch b in T. Since {b} is a cut-set in T, {b} partitions all vertices of T into two disjoint sets—one at each end of b. Consider the same partition of vertices in G, and the cut set S in G that corresponds to this partition. Cut-set S will contain only one branch b of T, and the rest (if any) of the edges in S are chords with respect to T.

Such a cut-set S containing exactly one branch of a tree T is called a fundamental cut-set with respect to T. Sometimes a fundamental cut-set is also called a basic cut-set.
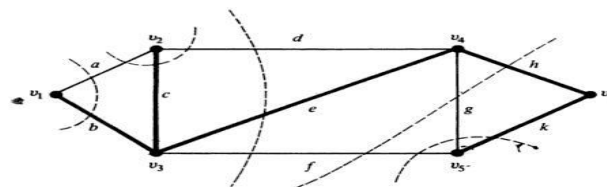
Fundamental cut sets of graph

T (in heavy lines) and all five of the fundamental cut-sets with respect to T are shown (broken lines "cutting" through each cut-set). Just as every chord of a spanning tree defines a unique.

7. Define Edge connectivity

Each cut-set of a connected graph G consists of a certain number of edges. The number of edges in smallest cut-set is defined as the edge connectivity of G.

8. **Define Vertex connectivity**

   The vertex connectivity of a connected graph G is defined as the minimum number of vertices whose removable from G leaves the remaining graph disconnected.

9. **Define flow in a network.**

   A flow in a network N is a function $f : VN \times VN \rightarrow R+$ such that $0 \leq f(e) \leq \alpha(e)$ for all e, and $f^-(v) = f^+(v)$ for all $v \notin \{s, r\}$.

   Example The value f (e) can be taught of as the rate at which transportation actually happens along the channel e which has the maximum capacity a(e).

   The second condition states that there should be no loss.

10. **Define block**

    A separable graph consists of two or more non separable subgraphs. Each of
    the largest non-separable subgraphs is called a block.
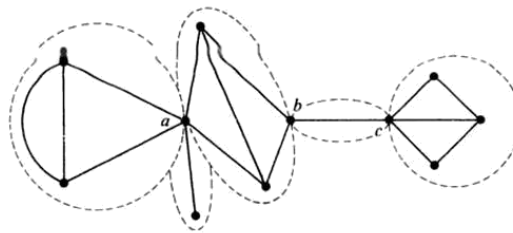
Separable graph with three cut-vertices and five block

11. **Two graphs G1 and G2 are said to be I-isomorphic if they become isomorphic to each other under repeated application of the following operation.**

    Operation I: "Split" a cut-vertex into twovertices to produce two disjoint subgraphs. From this definition it is apparent that two non-separable graphs are 1-isomorphic if and only if they are isomorphic.
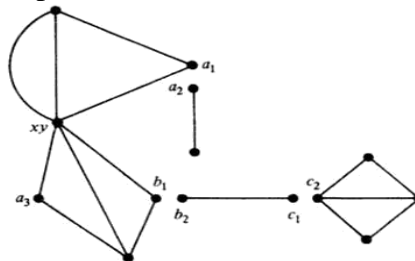
Graph 1- Isomorphic

12. **Define 2-isomorphic**

    Operation I: "Split" a cut-vertex into twovertices to produce two disjoint subgraphs. Operation 2: "Split" the vertex x into x1 and x2 and the vertex y into y1 and y2 such that G is split into g1 and g1. Let vertices x, and y, go with g1 and x2and yi with g1. Now rejoin the graphs g1 and g, by merging x, with y2 and x2 with y1.

    Two graphs are said to be 2-isomorphic if they become isomorphic after undergoing operation I or operation 2, or both operations any number of times.

13. **Define a planar Graph with an example (Dec-15)**

A graph (or multigraph) *G* is called *planar* if *G* can be drawn in the plane with its edges intersecting only at vertices of *G*. Such a drawing of *G* is called an *embedding* of *G* in the plane. *K*1,*K*2,*K*3,*K*4 are planar, *Kn* for *n>4* are nonplanar

14. Show that graph K$_5$ is non planar (July-15)
Ans: According to the corollary of eulers formula for planar graphs
Let G= (*V, E*) be a loop- free connected planar graph with | *V* |= *v*, | *E* |= *e* > 2,
and *r* regions. Then $3r \leq 2e$ and $e \leq 3v - 6$. For *K*5, *e* =10,*v* = 5, 3*v*-6=9< 10= e.
Therefore, by Corollary *K*5 is nonplanar.

15. Define planar graph. Prove that Petersen graph is non-planar. (June-15)
A planar graph is a graph that can be embedded in the plane, i.e., it can be drawn on
the plane in such a way that its edges intersect only at their endpoints. In other words,
it can be drawn in such a way that no edges cross each other.
We note that the graph (a) is the Peterson graph. By observing the graph, we note that
the vertices V$_1$,V$_3$,V$_6$ and V$_7$ can be assigned the same color, say α . Then the
vertices V$_2$,V$_4$, V$_8$ and V$_{10}$ can be assigned the same color, β (other than α) . Now, the
vertices V$_5$ and V$_9$ have to be assigned and β ; they can have the same color γ. Thus, a
minimum of three colors areαcolors other than required for a proper coloring of this
graph. Hence, the chromatic number of this graph is 3.

UNIT III

1. Define chromatic number
The chromatic number of a graph G is the smallest number of colors needed to color
the vertices of G so that no two adjacent vertices share the same color i.e., the smallest value
of k possible to obtain a k-coloring. The chromatic number of a graph G is most commonly
denoted $\chi(G)$.

2. What is K-Coloring?
A coloring using at most k colors is called a (proper) k-coloring. The smallest number
of colors needed to color a graph G is called its chromatic number, and is often denoted χ(G).
Sometimes γ(G) is used, since χ(G) is also used to denote the Euler characteristic of a graph.
A graph that can be assigned a (proper) k-coloring is k-colorable, and it is k-chromatic if its
chromatic number is exactly k. A subset of vertices assigned to the same color is called a
color class, every such class forms an independent set. Thus, a k-coloring is the same as a
partition of the vertex set into k independent sets, and the terms k-partite and k-colorable
have the same meaning.

3.What are the Types of Graph Coloring?
 1. Vertex coloring 2. Edge coloring

4.Define: Vertex Coloring
 A graph such that no two adjacent vertices share the same color; this is called a **vertex
coloring**

5. Define: Edge coloring
An edge coloring of a graph is a proper coloring of the *edges*, meaning an assignment
of colors to edges so that no vertex is incident to two edges of the same color.

6. Define Chromatic Partitioning:

An edge coloring with k colors is called a k-edge-coloring and is equivalent to the problem of partitioning the edge set into k matching's. The smallest number of colors needed for an edge coloring of a graph G is the chromatic index, or edge chromatic number, $\chi'(G)$.

7. What is Chromatic Polynomial?

The chromatic polynomial of a graph G counts the number of its proper vertex colorings. It is commonly denoted $P_G(k)$.

8. Define : Independent Set

A set of vertices in a graph is said to be Independent set of vertices (or an internally stable set) if no two vertices in the set are adjacent. A single vertex in any graph constitutes an independent set.

9. What is Matching of a graph?

A matching of graph G is a subgraph of G such that every edge shares no vertex with any other edge. That is, each vertex in matching M has degree one.A matching is maximum when it has the largest possible size. Note that for a given graph G, there may be several maximum matchings. The matching number of a graph is the size of a maximum matching of that graph.

10. Define: Covering:

In a graph G, a set g of edges is said to cover G if every vertex in G is incident on at least one edge on g. a set of edges that covers the graph G is said ti be an edge covering, a covering sub graph, or a simply a covering of G.A Hamiltonian circuit (if it exists) in a graph is also a covering.

11. Whar are the types of Digraphs?

The digrapgs are Simple digraphs,Asymmetric digraphs, symmetric digraphs, Complete digraph and regular digraph.

12. Define Euler Graph

In graph theory, an Eulerian trail (or Eulerian path) is a trail in a graph which visits every edge exactly once. Similarly, an Eulerian circuit or Eulerian cycle is an Eulerian trail which starts and ends on the same vertex.
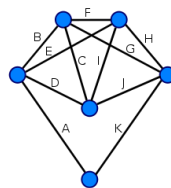
13. What is connected digraph?

A digraph is said to be strongly connected if there is atleast one directed path from every vertex to every other vertex. A digraph is said to be weakly connected if its corresponding undirected graph is connected but G is not strongly connected.

14. Define four color problems

Four color theorems, or the four color map theorem, state that, given any separation of a plane into regions, producing a figure called a *map*, no more than four colors are required to color the regions of the map so that no two adjacent regions have the same color. Two

regions are called *adjacent* if they share a common boundary that is not a corner, where corners are the points shared by three or more regions.

15. What is Isomorphic digraphs?

Isomorphic graphs were defined such that they have Identical behaviour in terms of graph properties. In other words, if their labels are removed, two isomprphic graphs are indistinguishable.

UNIT IV

1. **What is Permutation?**

   A permutation of [n] is a rearrangement of the elements of [n]. The number of permutations of a set of n objects is $n \times (n-1) \times \ldots \times 1 = n!$.

2. **How many k-subsets of [n] exist?**

   ` Let's consider a more specific case: how many 4-subsets of 6 are there

   $$\frac{6 \times 5 \times 4 \times 3}{4!}.$$

   For simplicity's sake, we will introduce notation for this, which we will refer to as a combination, denoted as

   $$\binom{n}{k} = \frac{n!}{k!(n-k)!} \text{ where } n, k \in \mathbb{Z} \geq 0.$$

   There are $\binom{n}{k}$ *k-subsets of* $[n]$.

3. **Define Fundamental counting Principle**

   The fundamental counting principle is a mathematical rule that allows you to find the number of ways that a combination of events can occur. For example, if the first event can occur 3 ways, the second event can occur 4 ways, and the third event can occur 5 ways, then you can find out the number of unique combinations by multiplying: 3 * 4 * 5 = 60 unique combinations.

4. **State Binomial Theorem:**

   $$(x + y)^n = \binom{n}{0}x^n y^0 + \binom{n}{1}x^{n-1}y^1 + \binom{n}{2}x^{n-2}y^2 + \ldots + \binom{n}{n-1}x^1 y^{n-1} + \binom{n}{n}x^0 y^n$$

   where each $\binom{n}{k}$ is a specific positive integer known as a binomial coefficient. (When an exponent is zero, the corresponding power expression is taken to be 1 and this multiplicative factor is often omitted from the term. Hence one often sees the right side written as $\binom{n}{0}x^n + \ldots$) this formula is also referred to as the binomial formula or the binomial identity.

5. **What is a Combinatorial Number?**

   A combinatorial number is created by two positive integers' m and n written one on top of the other, within brackets:

   $$\binom{m}{n} \quad , \text{Where } m \geq n$$

   To write them we will use the matrix tab in the formula editor, so that we will always insert a matrix with 1 column and 2 rows.

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6. **Define Inclusion and Exclusion principle:**

 The inclusion–exclusion principle is a counting technique which generalizes the familiar method of obtaining the number of elements in the union of two finite sets, symbolically expressed as $|A \cup B| = |A| + |B| - |A \cap B|$, where A and B are two finite sets and $|S|$ indicates the cardinality of a set S (which may be considered as the number of elements of the set, if the set is finite.

7. **What is derangement?**

 A permutation of n distinct objects in which none of the objects is in its natural or original place is called derangement. We represent the number of n distinct objects by Un. Thus $U_1 = 0$.

8. **How many arrangements of the letters in MISSISSIPPI have no consecutive S's?**
 Here is another way to think about this problem.
 The other letters will stand between the S's as separators: _M_I_I_I_P_P_I_
 The number of ways those can be arranged is: 7!(4!)(2!)7!(4!)(2!).
 Now there are eight blanks into which we can place the S's: (84)(84).

 Answer: (84)7!(4!)(2!)(84)7!(4!)(2!).

9. **How many permutations are there of the letters MATHEMATICS? How many of these permutations begin and end with the letter A? How many of these arrangements do NOT have two vowels adjacent to one another?**

 Using the permutation formula, we get 11!/(2!2!2!), since there are 2 M's, 2 A's and 2 T's in the word.

 Fixing an A in both the beginning and end location, we have 9 other letters to freely permute. This can be done in 9!/(2!2!) ways, accounting for the 2 M's and 2 T's.

 There are two ways to interpret the last question – we could count all of the permutations of MATHEMATICS with no adjacent vowels, OR, the just the ones that start and end with A that have no adjacent values. Here are solutions to both:

 From all permutations:

 There are 7 consonants and 4 vowels. Place the consonants like so:

 __ C __ C __ C __ C __ C __ C __ C __

 The consonants can be placed in those 7 locations in 7!/(2!2!) ways.

 Now, consider placing the vowels in the underlined gaps(__). The two A's can be placed in $_8C_2$ locations, since we will choose 2 out of the 8 locations for the As. Then the E can be placed in any of the 6 remaining locations and the I can be placed in any of the 5 remaining locations.

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Using the multiplication principle, we get the answer to be $\dfrac{7!}{2!2!}\dbinom{8}{2}(6)(5)=1058400$.

From permutations that start and end with A:
There are 7 consonants and 2 vowels left to place. Place the consonants like so:
A C __ C __ C __ C __ C __ C __ C A
Once again, the consonants canb e placed in those 7 locations in $7!/(2!2!)$ ways.
The E can be placed in 6 places while the I can be placed in the remaining 5 places. The logic here is exactly the same as above, but there is exactly one location for the pair of As. So, the final answer here is $1058400/28 = 37800$.

10. How many different letter arrangements can be made from the letters:
   a) FLUKE
    b) PROPOSE
   c) MISSISSIPPI
   d) ARRANGE

   Solution:
   a) all the letters are different so we can make $5! = 120$ arrangements

   b) We have 7 letters that can be permuted in $7!$ ways but because some of the letters repeat themselves we counted some of the arrangements more than once. So the actual number of dictinct ways to arrange the letters is $7!/(2!*2!) = 1260$ (we have 2 P's which were counted $2!$ Times and 2O's permuted again $2!$ Times)

   c) The letters which are repeating are $I – 4$ times ,$S – 4$ times and $P - 2$ times so the answer should be (following the same reasoning as before) $11!/(4!*4!*2!) = 34,650$

   d) We have 2 A's and 2 R's so , $7!/(2!*2!) =1260$ ways of arranging the letters

UNIT V

1. **Solve the recurrence relation $F_n = 5F_{n-1} − 6F_{n-2}$ where $F_0 = 1$ and $F_1 = 4$**
    Solution
    The characteristic equation of the recurrence relation is −
    $x^2 − 5x + 6 = 0$,
    So, $(x − 3)(x − 2) = 0$
    Hence, the roots are −
    $x_1 = 3$ and $x_2 = 2$
    The roots are real and distinct. So, this is in the form of case 1
    Hence, the solution is −
    $F_n = ax_1^n + bx_2^n$
    Here, $F_n = a3^n + b2^n$ (As $x_1 = 3$ and $x_2 = 2$)
    Therefore,
    $1 = F_0 = a3^0 + b2^0 = a+b$
    $4 = F_1 = a3^1 + b2^1 = 3a+2b$
    Solving these two equations, we get $a = 2$ and $b = −1$
    Hence, the final solution is −
    $F_n = 2.3^n + (−1) . 2^n = 2.3^n − 2^n$

2. **Solve the recurrence relation $F_n = 10F_{n-1} − 25F_{n-2}$ where $F_0 = 3$ and $F_1 = 17$**

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Solution
The characteristic equation of the recurrence relation is −
$x^2 − 10x − 25 = 0$,
So, $(x − 5)^2 = 0$
Hence, there is single real root $x_1 = 5$
As there is single real valued root, this is in the form of case 2
Hence, the solution is −
$F_n = ax_1^n + bnx_1^n$
$3 = F_0 = a.5^0 + b.0.5^0 = a$
$17 = F_1 = a.5^1 + b.1.5^1 = 5a+5b$
Solving these two equations, we get $a = 3$ and $b = 2/5$
Hence, the final solution is −
$F_n = 3.5^n + (2/5) .n.2^n$

3. **Solve the recurrence relation $F_n = 2F_{n−1} − 2F_{n−2}$ where $F_0 = 1$ and $F_1 = 3$**
   Solution
   The characteristic equation of the recurrence relation is −
   $x^2 − 2x − 2 = 0$
   Hence, the roots are −
   $x_1 = 1 + i$ and $x_2 = 1 − i$
   In polar form,
   $x_1 = r \angle \theta$ and $x_2 = r \angle(− \theta)$, where $r = \sqrt{2}$ and $\theta = \pi / 4$
   The roots are imaginary. So, this is in the form of case 3.
   Hence, the solution is −
   $F_n = (\sqrt{2})^n (a \cos(n. \pi / 4) + b \sin(n. \pi / 4))$
   $1 = F_0 = (\sqrt{2})^0 (a \cos(0. \pi / 4) + b \sin(0. \pi / 4)) = a$
   $3 = F_1 = (\sqrt{2})^1 (a \cos(1. \pi / 4) + b \sin(1. \pi / 4)) = \sqrt{2} (a/\sqrt{2} + b/\sqrt{2})$
   Solving these two equations we get $a = 1$ and $b = 2$
   Hence, the final solution is −
   $F_n = (\sqrt{2})n (\cos(n. \pi / 4) + 2 \sin(n. \pi / 4))$
   Particular Solutions
   A recurrence relation is called non-homogeneous if it is in the form
   $F_n = AF_{n−1} + BF_{n−2} + F(n)$ where $F(n) \neq 0$
   The solution (a_n) of a non-homogeneous recurrence relation has two parts. First part is the solution (a_h) of the associated homogeneous recurrence relation and the second part is the particular solution (at). So, $a_n = a_h + a_t$.
   Let $F(n) = cx^n$ and x_1 and x_2 are the roots of the characteristic equation −
   $x^2 = Ax + B$ which is the characteristic equation of the associated homogeneous recurrence relation −
   If $x \neq x_1$ and $x \neq x_2$, then $a_t = Ax^n$
   If $x = x_1$, $x \neq x_2$, then $a_t = Anx^n$
   If $x = x_1 = x_2$, then $a_t = An^2x^n$

4. **Solve the recurrence relation $F_n = 3F_{n−1} + 10F_{n−2} + 7.5^n$ where $F_0 = 4$ and $F_1 = 3$**
   Solution
   The characteristic equation is −
   $x^2 − 3x − 10 = 0$
   Or, $(x − 5)(x + 2) = 0$
   Or, $x_1 = 5$ and $x_2 = −2$
   Since, $x = x_1$ and $x \neq x_2$, the solution is −
   $a_t = Anx^n = An5^n$
   After putting the solution into the non-homogeneous relation, we get −
   $An5^n = 3A(n − 1)5^{n−1} + 10A(n − 2)5^{n−2} + 7.5^n$
   Dividing both sides by $5^{n−2}$, we get −
   $An5^2 = 3A(n − 1)5 + 10A(n − 2)5^0 + 7.5^2$
   Or, $25An = 15An − 15A + 10An − 20A + 175$
   Or, $35A = 175$
   Or, $A = 5$
   So, $F_n = n5^{n+1}$
   Hence, the solution is −
   $F_n = n5^{n+1} + 6.(−2)^n − 2.5^n$

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5. **Define Generating Functions**

Definition of generating function. The generating function for the sequence a_0, a_1... is defined to be the function $f(x) = \sum_{n=0}^{\infty} a_n x^n$.

6. **Define the partial sum of Fibonacci sequence**

The partial sum of Fibonacci sequence is $s_n = f_0 + f_1 + f_2 + \cdots + f_n = f_{n+2} - 1$. (2) This can be verified by induction on n. For $n = 0$, we have $s_0 = f_2 - 1 = 0$. Now for $n \geq 1$, we assume that it is true for $n - 1$, i.e., $s_{n-1} = f_{n+1} - 1$. Then $s_n = f_0 + f_1 + \cdots + f_n = s_{n-1} + f_n = f_{n+1} - 1 + f_n$ (by the induction hypothesis) $= f_{n+2} - 1$. (by the Fibonacci recurrence)

4.Deriving generating functions from recurrences. If you are given a sequence defined by a recurrence relation and initial conditions, you can use these to get a generating function for the sequence. Having done that, you can then apply the facts and methods above to get a formula for the n-th term of the sequence. This is another method of solving recurrences. We'll illustrate the method first, and then try to give a description of it below. It would be wise to work through the example twice: once before reading the description of the method, and once after. That way you should be able to recognize (and understand) the major steps.

7. **Define Linear recurrences.**

Linear recurrences
1. Linear homogeneous recurrences
2. Linear non-homogeneous recurrences

8. **Define Linear homogeneous recurrences**

A linear homogenous recurrence relation of degree k with constant coefficients is a recurrence relation of the form

$$a_n = c_1 a_{n-1} + c_2 a_{n-2} + \ldots + c_k a_{n-k},$$

where $c_1, c_2, \ldots, c_k$ are real numbers, and $c_k \neq 0$.
a_n is expressed in terms of the previous k terms of the sequence, so its degree is k.
This recurrence includes k initial conditions. $a_0 = C_0$ $a_1 = C_1$ … $a_k = C_k$

9. **How do we find a particular solution?**

Theorem:

Consider $a_n = c_1 a_{n-1} + \ldots + c_k a_{n-k} + F(n)$ where: $F(n) = (b_t n^t + b_{t-1} n^{t-1} + \ldots + b_1 n + b_0) s^n$ I Case 1: If s is not a root of the associated characteristic equation, then there exists a particular solution of the form: $(p_t n^t + p_{t-1} n^{t-1} + \ldots + p_1 n + p_0) s^n$ I Case 2: If s is a root with multiplicity m of the characteristic equation, then there exists a solution of the form: $n^m (p_t n^t + p_{t-1} n^{t-1} + \ldots + p_1 n + p_0) s^n$

10. **Define Particular Solution**

A particular solution for a recurrence relation is one that satisfies the recurrence but not necessarily the initial conditions I Example: Consider the recurrence $a_n = a_{n-1} + 1$ with initial condition $a_0 = 5$ I A particular solutions for this recurrence is $a_n = n$, but it does not satisfy the initial condition.

11. **Theorem about Linear Non-homogeneous Recurrences**

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Suppose an = c1an−1 + . . . + ckan−k + F(n) has particular solution a p n , and a h n is solution for associated homogeneous recurrence. Then every solution is of the form a p n + a h n . I Proof: Since a p n is a particular solution, it satisfies: a p n = c1a p n−1 + . . . + cka p n−k + F(n) I If bn is another solution, it must also satisfy: bn = c1bn−1 + . . . + ck bn−k + F(n) I But bn − a p n is a solution of the homogeneous recurrence relation; hence every solution is of the form a p n + a h n

12. **Define Moment Generating Functions**

Let *X* denote a random variable with probability density function
f(*x*) if continuous (probability mass function *p*(*x*) if discrete)
Then

$m_X(t)$ = the moment generating function of *X*

$$= E\left(e^{tX}\right)$$

$$= \begin{cases} \int_{-\infty}^{\infty} e^{tx} f(x)\,dx & \text{if } X \text{ is continuous} \\ \sum_x e^{tx} p(x) & \text{if } X \text{ is discrete} \end{cases}$$

13. What is M. G. F.'s - Continuous distributions?

Name	Moment generating function $M_X(t)$
Continuous Uniform	$\dfrac{e^{bt}-e^{at}}{[b-a]t}$
Exponential	$\left[\dfrac{\lambda}{\lambda-t}\right]$ for $t < \lambda$
Gamma	$\left[\dfrac{\lambda}{\lambda-t}\right]^{\alpha}$ for $t < \lambda$
χ^2 ν d.f.	$\left[\dfrac{1}{1-2t}\right]^{\nu/2}$ for $t < 1/2$
Normal	$e^{t\mu+(1/2)t^2\sigma^2}$

14. What is M. G. F.'s - Discrete distributions

Name	Moment generating function $M_X(t)$
Discrete Uniform	$\dfrac{e^t}{N}\dfrac{e^{tN}-1}{e^t-1}$
Bernoulli	$q + pe^t$
Binomial	$(q + pe^t)^N$
Geometric	$\dfrac{pe^t}{1-qe^t}$
Negative Binomial	$\left[\dfrac{pe^t}{1-qe^t}\right]^k$
Poisson	$e^{\lambda(e^t-1)}$

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PART – B

UNIT – I

1. Prove that any two simple connected graph with n vertices, all of degree two, are isomorphic.
2. Prove that "The number of vertices of odd degree in a graph is always even". (Dec 14)
3. Prove that "A simple graph with n vertices and k components can have at most (n-k)(n-k+1)/2 edges".
4. Prove that a connected graph G remains connected after removing an edge e_i from G, if and only if e_i is in some circuit in G.
5. Prove that "A graph G is an Euler graph if and only if all vertices of G are of even degree."
6. Prove that a connected graph G is an Euler if and only if it can be decomposed into circuits.
7. Prove that a complete graph with n vertices there are (n-1)/2 edge-disjoint Hamiltonian circuits, if n is an odd number ≥ 3.
8. Observe that there can be no path longer than a Hamiltonian path (if it exists) in a graph.
9. Prove that every tree has either one or two centers.
10. Show that distance between vertices of a connected graph is a metric.

UNIT – II

1. Prove that in a tree every vertex of degree greater than one is a cut-vertex.
2. Show that a graph G is nonseparable if and only if every vertex pair in G can be placed in some circuit in G.
3. Prove that every connected graph with three or more vertices has at least two vertices which are not cut-vertices.
4. Prove that an Euler graph cannot have a cut-set with an odd number of edges.
5. Show that two graphs with the same rank and the same nullity need not be 2-isomorphic.
6. Prove that the complete graph of five vertices is nonplanar.
7. Prove that Kuratowski's second graph is also nonplanar.
8. State and prove Euler's formula for a planar graph (Jan-14)
9. Any simple planar graph can be embedded in a plane such that every edge is drawn as straight line segment.
10. Is every regular graph of degree (d$\geq$3) nonseparable? If not, give a simple regular graph of degree three that is separable.

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UNIT - III

1. Prove that Every tree with two or more vertices in 2- chromatic.
2. Prove that a graph with atleast one edge is 2- chromatic if and only if it has no circuits of odd length.
3. prove that a graph of n vertices is a coplete graph if and only if its chromatic polynomial is
   $P_n(\lambda) = \lambda(\lambda - 1)(\lambda - 2)......(\lambda - n + 1)$
4. Prove that a graph G has an Eulerian path iff G is connected and has at most two vertices of odd degree.
5. 5.Prove that If all vertices of graph G have the same degree and G is bipartite, then there exists a complete matching in G. Furthermore, the edges of G can be partitioned into complete matchings.
6. 6.) Find a graph (on 6 vertices) whose coloring (chromatic) number is 2 but whose list coloring number is 3. How many vertices do you need to make the list coloring number of a bipartite graph equal to 4?
7. Sketch two different (i.e., Nonisomorphic) graphs that have the same chromatic polynomial.
8. Prove that in any digraph the sum of the in- degrees of all vertices is equal to the sum of their out-degrees, and this sum is equal to the number of edges in the digraph.
9. Check the combinations of reflexivity, symmetry, and transitivity define eight (2^3 =8) types of binary relations. Two such relations are equivalence and partial order.
10. Prove that every Euler digraph is strongly connected.

UNIT - IV

1. Define derangement. There are eight letters to eight different people to placed in eight different addressed envelopes. Find the number of ways of doing this so that at least one letter gets to the right person.
2. Determine the number of positive integers n such that $1 \le n \le 100$ and n is not divisible by 2,3,or 5.
3. How many arrangements are there for all letters in the word SOCIOLOGICAL? In how many of these arrangements; (1) A and G are adjacent (ii) All the vowels are adjacent.
4. In how many ways can one distribute eight identical balls in to four distinct containers so that, (i) no container is left empty, (ii) the fourth container gets an odd number of balls.
5. Determine the coefficient of:
   i. $x^9.y^3$ in the expansion of $(2x - 3y)^{12}$
   ii. $x.y.z^2$ in the expansion of $(2x - y - z)^4$
   iii. $x^2.y^{2.}.z^3$ in the expansion of $(3x - 2y - 4z)^7$
6. Find the coefficient of x^{15} in $\dfrac{(1 + x)^4}{(1 - x)^4}$
7. In certain implementation of the programming language Pascal, an identifier consists of a single letter or a letter followed by up to seven symbols, which maybe letters or

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digits (26 letters, 10 digits). There are 36 reversal words. How many distinct identifiers are possible in this version of pascal?

8. For the positive integers 1,2,3,4 there are n derangements. Define derangements. What is the value of n?.

9. Determine the number integer solutions for $x_1 + x_2 + x_3 + x_4 + x_5 < 40$, where

   i. $x_i \geq 0, 1 \leq i \leq 5$

   ii. $x_i \geq -3, 1 \leq i \leq 5$

10. Five teachers T_1, T_2, T_3, T_4, T_5 are to be made class teachers for the classes C_1, C_2, C_3, C_4, C_5. one teacher for each class. T_1 and T_2 do not wish to class teachers for C_1 or C_2, T_3 and T_4 for C_4 or C_5 and T_5 for C_3 or C_4 or C_5. In how many ways can the teachers be assigned the work?

UNIT – V

1. Using the summation operator theory, find a formula to express 02 + 12 + 22 + ...+ n2 as a function of n.

2. Determine the coefficient of x 8 in 2 1 − −(3)(2) x x

3. In how many ways can a police captain distribute 24 rifle shells to four police officers so that each officer gets at least three shells, but not more than eight?

4. In each of the following, the f unction f(x) is the generating function for the sequence a0, a1, a2… whereas the sequence b0, b1, b2,… is generated by the function g(x). Express g(x) in terms of f(x). (i) b3=3 bn=an, n∈N, n≠3 (ii) b3=3 b7=7 bn=an, n∈N, n≠3, 7

5. Find the generating function for pd(n), the number of partitions of a positive integer n into distinct summands.

6. Find all partitions of 7.

7. Determine the sequence generated by each of the following generating functions. 3 3 2) ( ) (2 3)) ( ) (1) a f x x x x b f x x − = = −

8. Find the exponential generating function for the sequence 0!1!2!3!...

9. Using the generating function method, Solve the recurrence relation : , given a0 =1.

10. A bank pays 6% interest compounded quarterly. If Laura invests $100 then how many months must she wait for her money to double?

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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 71691

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Seventh/Eighth Semester

Computer Science and Engineering

CS 6702 — GRAPH THEORY AND APPLICATIONS

(Common to Information Technology)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Euler graph. Show that an Euler graph is connected except for any isolated vertices the graph may have.

2. Can there be a path longer than a Hamiltonian path (if any) in a simple, connected, undirected graph? Why?

3. Define planar graphs.

4. Identify two spanning trees for the following graph :
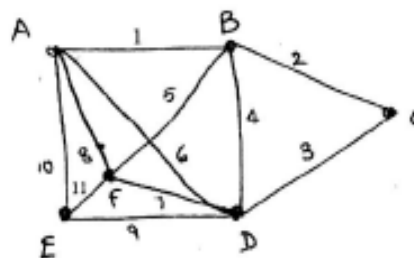
5. Does the following graph have a maximal matching? Give reason.
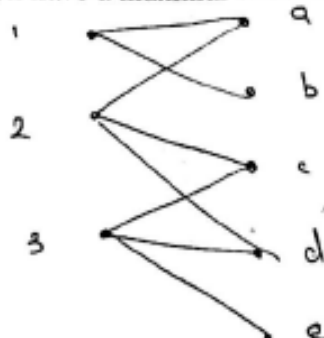
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6. Draw K_8 and K_9 and show that thickness of K_8 is 2 while thickness of K_9 is 3.

7. State the rule of sum, the first principle of counting.

8. Use Venn diagram to represent the following scenario :

   If S : a set, C_1 = condition 1 and C_2 – condition 2 satisfied by some elements of S, indicate on the diagram – S, $N(C_1)$, $N(C_2)$ $N(C_1, C_2)$ and $N(\overline{C_1}, \overline{C_2})$.

9. Give explanation for the following :
   Generating function for
   the no. of ways to have
   n cents in pennies and nickels
   $$= \left(1 + x + x^2 + ...\right)\left(1 + x^5 + x^{10} + ...\right)$$

10. Solve the recurrence relation $a_{n+1} - a_n = 3n^2 - n$ $n \geq 0$ $a_0 = 3$.

PART B — (5 × 16 = 80 marks)

11. (a) Define the following terms :

    (i) Walk
    (ii) Euler path
    (iii) Hamiltonian path
    (iv) Subgraph
    (v) Circuit
    (vi) Complete graph   (6)

    From the given graph draw the following :

    (vii) Walk of length 6
    (viii) Is this an Euler graph? Give reasons
    (ix) Is there a Hamiltonian path for this graph? Give reasons
    (x) Find atleast two complete subgraphs   (10)
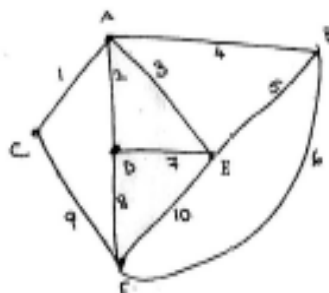
Or

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(b) (i) List any five properties of trees. (6)

(ii) Define eccentricity of a vertex V in a tree T and give an example tree and its eccentricity from the root. (10)

12. (a) (i) Define spanning tree and give an example.

(ii) A farm has six walled plots full of water. The graph representation of it is given below. Use the concepts of spanning tree, cutsets appropriately to determine the following :

(1) How many walls will have to be broken so that all the water can be drained out?

(2) If only one plot was full of water and this had to be drained into all other plots, then how many walls need to be broken?
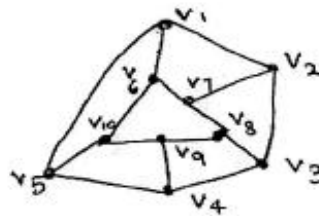
Or

(b) State the Eulers formula relating the number of vertices, edges and faces of a planar connected graph. Give two conditions for testing for planarity of a given graph. Give a sample graph that is planar and another that is non-planar.

13. (a) Describe the steps to find adjacency matrix and incidence matrix for a directed graph with a simple example.

Or

(b) Write a note on chromatic polynomials and their applications.

14. (a) In how many ways can the 26 letters of the alphabet be permuted so that the patterns car, dog, pun or byte occures? Use the principle of inclusion and exclusion for this.

Or

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(b)   When n balls numbered 1, 2, 3 ... n are taken in succession from a container, a rencontre occurs if m^{th} ball withdrawn is numbered $m, 1 \leq m \leq n$.

Find the probability of getting

(i)   no rencontres.

(ii)   exactly one rencontre

(iii) Atleast one rencontre and

(iv) r rencontries $1 \leq r \leq n$. Show intermediate steps.

15.   (a)   If a_n is count of number of ways a sequence of 1s and 2s will sum to n, for $n \geq \theta$. Eg $a_3 = 3$ (i) 1, 1, 1 ; (ii) 1, 2, and (iii) 2, 1 sum up to 3.

Find and solve a sequence relation for a_n.

Or

(b)   What are Ferrers diagrams? Describe how they are used to (i) represent integer partition (ii) Conjugate diagram or dual partitions (iii) self-conjugates (iv) representing bisections of two partition.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 80305

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Seventh Semester

Computer Science and Engineering

CS 6702 — GRAPH THEORY AND APPLICATIONS

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define walk, path and circuit in a graph.

2. What is meant by eccentricity?

3. Define 1–isomorphic and 2–isomorphic.

4. What are the applications of planar graph?

5. Define minimal dominating set and maximal independent set.

6. Find the chromatic number of a complete graph of n vertices.

7. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?

8. A committee including 3 boys and 4 girls is to be formed from a group of 10 boys and 12 girls. How many different committees can be formed from the group?

9. Define recurrence relation.

10. Define generating function.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Show that the maximum number of edges in a simple graph with n vertices is $n(n-1)/2$. (6)

    (ii) Prove that if a graph has exactly two vertices of odd degree, there must be path joining these two vertices. (5)

    (iii) Prove that any two simple connected graphs with n vertices, all of degree two, are isomorphic. (5)

Or

(b) (i) Mention some of the properties of tree. (5)

(ii) Prove that in any tree, there are atleast two pendant vertices. (5)

(iii) Show that a Hamiltonian path is a spanning tree. (6)

12. (a) (i) Explain max- flow min-cut theorem. (10)

(ii) Explain about Fundamental cut set and Fundamental circuit in a graph. (6)

Or

(b) (i) Prove that every connected graph has atleast one spanning tree. (6)

(ii) Prove the graphs K_5 and $K_{3,3}$ are non planar. (10)

13. (a) (i) Prove that every tree with two or more vertices is 2-chromatic. (5)

(ii) Prove that a graph of n vertices is a complete graph iff its chromatic polynomial is

$$P_n(\lambda) = \lambda(\lambda - 1)(\lambda - 2)\ldots(\lambda - n + 1).$$ (6)

(iii) Prove that a covering g of a graph is minimal iff g contains no paths of length three or more. (5)

Or

(b) (i) Explain Euler digraph. (10)

(ii) Discuss about some types of digraph with suitable example. (6)

14. (a) (i) How many arrangements are there of all the vowels adjacent in SOCIOLOGICAL? (4)

(ii) Find the value of n for the following : $2P(n, 2) + 50 = P(2n, 2)$. (5)

(iii) How many distinct four-digit integers can one make from the digits 1, 3, 3, 7, 7 and 8? (4)

(iv) In how many possible ways could a student answer a 10-question true-false test? (3)

Or

(b) (i) How many arrangements of the letters in MISSISSIPPI has no consecutive S's? (4)

(ii) A gym coach must select 11 seniors to play on a football team. If he can make his selection in 12,376 ways, how many seniors are eligible to play? (4)

(iii) How many permutations of size 3 can one produce with the letters m, r, a, f and t? (4)

(iv) Rama has two dozen each of n different colored beads. If she can select 20 beads (with repetitions of colors allowed), in 230,230 ways, what is the value of n? (4)

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15. (a) (i) Discuss about exponential generating function with an example. (10)

     (ii) Find the unique solution of the recurrence relation $6a_n - 7a_{n-1} = 0, n \geq 1, a_3 = 343$. (6)

<div align="center">Or</div>

(b) (i) The population of Mumbai city is 6,000,000 at the end of the year 2015. The number of immigrants is 20000 n at the end of year n. The population of the city increases at the rate of 5% per year. Use a recurrence relation to determine the population of the city at the end of 2025. (8)

     (ii) Write short notes on summation operator. (8)

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CS6703   **GRID AND CLOUD COMPUTING**   **L T P C**
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UNIT I   INTRODUCTION   9
Evolution of Distributed computing: Scalable computing over the Internet – Technologies for network based systems – clusters of cooperative computers - Grid computing Infrastructures – cloud computing - service oriented architecture – Introduction to Grid Architecture and standards – Elements of Grid – Overview of Grid Architecture.

UNIT II   GRID SERVICES   9
Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements –Practical & Detailed view of OGSA/OGSI – Data intensive grid service models – OGSA services.

UNIT III VIRTUALIZATION   9
Cloud deployment models: public, private, hybrid, community – Categories of cloud computing:
Everything as a service: Infrastructure, platform, software - Pros and Cons of cloud computing –
Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

UNIT IV PROGRAMMING MODEL   9
Open source grid middleware packages – Globus Toolkit (GT4) Architecture , Configuration – Usage of Globus – Main components and Programming model - Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.

UNIT V SECURITY   9
Trust models for Grid security environment – Authentication and Authorization methods – Grid
security infrastructure – Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, I am practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
 Apply grid computing techniques to solve large scale scientific problems.
 Apply the concept of virtualization.
 Use the grid and cloud tool kits.
 Apply the security models in the grid and the cloud environment.

TEXT BOOK:
1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.
REFERENCES:

1. Jason Venner, "Pro Hadoop- Build Scalable, Distributed Applications in the Cloud", A Press, 2009
2. Tom White, "Hadoop The Definitive Guide", First Edition. O'Reilly, 2009.
3. Bart Jacob (Editor), "Introduction to Grid Computing", IBM Red Books, Vervante, 2005
4. Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", 2nd Edition, Morgan Kaufmann.
5. Frederic Magoules and Jie Pan, "Introduction to Grid Computing" CRC Press, 2009.
6. Daniel Minoli, "A Networking Approach to Grid Computing", John Wiley Publication, 2005.
7. Barry Wilkinson, "Grid Computing: Techniques and Applications", Chapman and Hall, CRC, Taylor and Francis Group, 2010.

2 MARK QUESTIONS WITH ANSWERS
UNIT I - INTRODUCTION

1. What is Grid Computing?

Grid computing is a processor architecture that combines computer resources from various domains to reach a main objective. In **grid computing**, the **computers** on the network can work on a task together, thus functioning as a supercomputer.

2. What is QOS?

Grid computing system is the ability to provide the quality of service requirements necessary for the end-user community. QOS provided by the grid like performance, availability, management aspects, business value and flexibility in pricing.

3. What are the derivatives of grid computing?

There are 8 derivatives of grid computing. They are as follows:
  a) Compute grid
  b) Data grid
  c) Science grid
  d) Access grid
  e) Knowledge grid
  f) Cluster grid
  g) Terra grid
  h) Commodity grid

4. What are the features of data grids?

The ability to integrate multiple distributed, heterogeneous and independently managed data sources. The ability to provide data catching and/or replication mechanisms to minimize network traffic. The ability to provide necessary data discovery mechanisms, which allow the user to find data based on characteristics of the data.

5. Define – Cloud Computing.

Cloud computing, often referred to as simply "the cloud," is the delivery of on-demand computing resources—everything from applications to data centers—over the Internet on a pay-for-use basis. Storing and accessing data and programs over the Internet instead of your computer's hard drive

6. What is business on demand?

Business On Demand is not just about utility computing as it has a much broader set of ideas about the transformation of business practices, process transformation, and technology implementations.

The essential characteristics of on-demand businesses are responsiveness to the dynamics of business, adapting to variable cost structures, focusing on core business competency, and resiliency for consistent availability.

7. What are the facilities provided by virtual organization?

The formation of virtual task forces, or groups, to solve specific problems associated with the virtual organization.

The dynamic provisioning and management capabilities of the resource required meeting the SLA's.

8. What are the properties of Cloud Computing?

There are six key properties of cloud computing: Cloud computing is

- user-centric
- task-centric
- powerful
- accessible
- intelligent
- programmable

9. Sketch the architecture of Cloud.
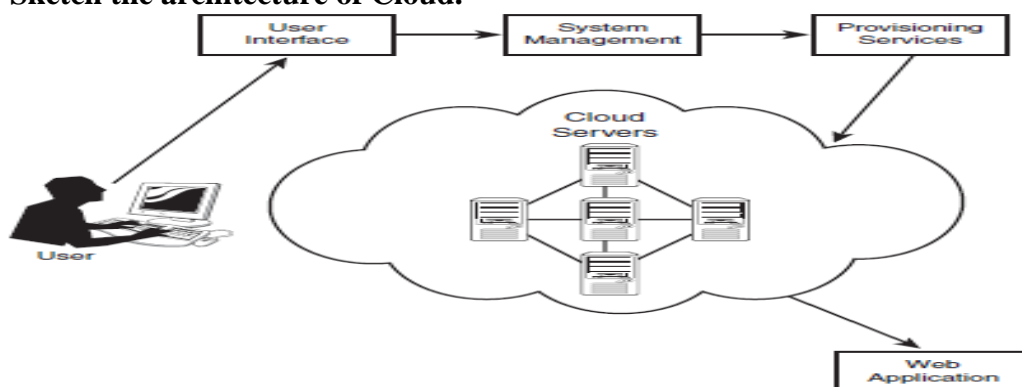
10. What are the types of Cloud service development?

- Software as a Service
- Platform as a Service
- Web Services
- On-Demand Computing

11. What is meant by scheduler?

Schedulers are types of applications responsible for the management of jobs, such as allocating resources needed for any specific job, partitioning of jobs to schedule parallel execution of tasks, data management, event correlation, and service-level management capabilities.

12. What is meant by resource broker?

Resource broker provides pairing services between the service requester and the service provider. This pairing enables the selection of best available resources from the

service provider for the execution of a specific task.

13. What is load balancing?

Load balancing is concerned with the integrating the system in order to avoid processing delays and over-commitment of resources. It involves partitioning of jobs, identifying the resources and queuing the jobs.

14. What is grid infrastructure?

Grid infrastructure forms the core foundation for successful grid applications. This infrastructure is a complex combination of number of capabilities and resources identified for the specific problem and environment being addressed.

15. Define – Distributed Computing.

Distributed computing is a field of **computer** science that studies **distributed** systems. A **distributed** system is a software system in which components located on networked **computers** communicate and coordinate their actions by passing messages. The components interact with each other in order to achieve a common goal.

16. List the challenges of P2P computing.

P2P computing faces three types of heterogeneity problems in hardware, soware, and network requirements. There are too many hardware models and architectures to select from; incompatibility exists between software and the OS; and different network connections and protocols make it too complex to apply in real applications. We need system scalability as the workload increases.

17. Define IOT

The dynamic connections will grow exponentially into a new dynamic network of networks, called the Internet of Things (IoT).

18. List the Technologies for Network-Based Systems.

- Multicore CPUs and Multithreading Technologies
- Multicore CPU and Many-Core GPU Architectures
- Multithreading Technology

19. .How GPUs Work

Modern GPUs are not restricted to accelerated graphics or video coding. They are used in HPC systems to power supercomputers with massive parallelism at multicore and multithreading levels. GPUs are designed to handle large numbers of floating-point operations in parallel. In a way , the GPU offloads the CPU from all data-intensive calculations, not just those that are related to video processing. Conventional GPUs are widely used in mobile phones, game consoles, embedded systems, PCs, and servers. The NVIDIA CUDA Tesla or Fermi is used in GPU clusters or in HPC systems for parallel processing of massive floating-pointing data.

20. Draw the cluster Architecture.

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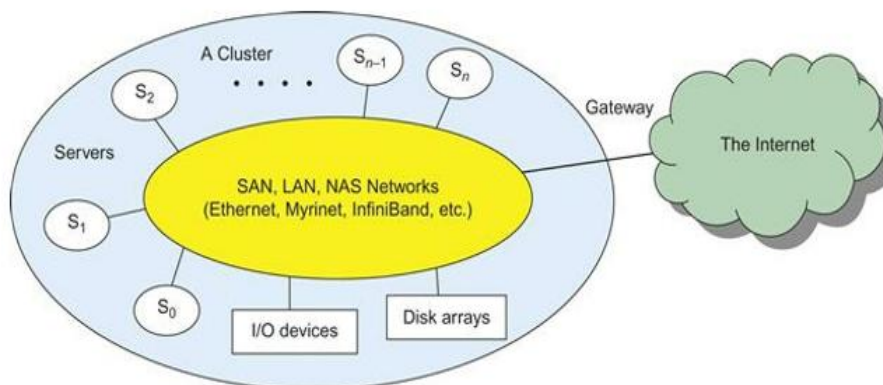
UNIT II - GRID SERVICES

1. Define – OSGI.

Open Grid Services Architecture (OGSA) is a set of standards defining the way in which information is shared among diverse components of large, heterogeneous grid systems. In this context, a grid system is a scalable wide area network (WAN) that supports resource sharing and distribution. OGSA is a trademark of the Open Grid Forum.

2. Define – OSGA.

The **Open Grid Services Infrastructure** (OGSI) was published by the Global Grid Forum (GGF) as a proposed recommendation in June 2003.[1] It was intended to provide an infrastructure layer for the Open Grid Services Architecture (OGSA). OGSI takes the statelessness issues (along with others) into account by essentially extending Web services to accommodate grid computing resources that are both transient and stateful.

3. Define – Peer to Peer Computing.

Peer to Peer computing is a relatively new computing discipline in the realm of distributed computing. P2P system defines collaboration among a larger number of individuals and/or organizations, with a limited set of security requirements and a less complex resource-sharing topology.

4. What is Dynamic Accounting System?

DAS provides the following enhanced categories of accounting functionality to the IPG community:
* Allows a grid user to request access to a local resource via the presentation of grid credentials
* Determines and grants the appropriate authorizations for a user to access a local resource without requiring a preexisting account on the resource to govern local authorizations.

5. Define – SOA.

A service-oriented architecture is intended to define loosely coupled and interoperable services/applications, and to define a process for integrating these interoperable components.

6. What are the major goals of OSGA?
* Identify the use cases that can drive the OGSA platform components.
* Identify and define the core OGSA platform components.
* Define hosting and platform specific bindings.
* Define resource models and resource profiles with interoperable solutions.

7. What are the layers available in OGSA architectural organizations?
* Native platform services and transport mechanisms.
* OGSA hosting environment.
* OGSA transport and security.
* OGSA infrastructure (OGSI).

- OGSA basic services (meta-OS and domain services)

8. What is meant by grid infrastructure?

Grid infrastructure is a complex combination of a number of capabilities and resources identified for the specific problem and environment being addressed. It forms the core foundations for successful grid applications.

9. List some grid computing toolkits and frameworks?
- Globus Toolkit
- Globus Resource Allocation Manager(GRAM)
- Grid Security Infrastructure(GSI)
- Information Services
- Legion
- Condor and Condor-G
- NIMROD
- UNICORE
- NMI

10. Define - GRAM.

GRAM provides resource allocation, process creation, monitoring, and management services. The most common use of GRAM is the remote job submission and control facility. GRAM simplifies the use of remote systems.

11. What is the role of the grid computing organization?
- Organizations developing grid standards and best practices guidelines.
- Organizations developing grid computing toolkits, frameworks and middleware solutions.
- Organizations building and using grid - based solutions to solve their computing, data, and network requirements.
- Organizations working to adopt grid concepts into commercial products, via utility computing and business on demand computing.

12. What are the different layers of grid architecture?
- Fabric Layer: Interface to local resources
- Connectivity Layer: Manages Communications
- Collective Layer: Coordinating Multiple Resources
- Application Layer: User Defined Application.

13. What are the fundamental components of SOAP specification?
- An envelope that defines a framework for describing message structure.
- A set of encoding rules for expressing instances of application defined data types
- A convention for representing remote procedure (RPC) and responses.
- A set of rules for using SOAP with HTTP.
- Message exchange patterns (MEP) such as request-response, one-way and peer-to-peer conversations.

14. Define - SOAP.

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SOAP is a simple and lightweight XML-based mechanism for creating structured data packages that can be exchanged between network applications. SOAP provides a simple enveloping mechanism and is proven in being able to work with existing networking services technologies such as HHTP.SOAP is also flexible and extensible. SOAP is based on the fact that it builds upon the XML info set.

15. Define WSDL.

WSDL is an XML Info set based document, which provides a model and XML format for describe web services. This enables services to be described and enables the client to consume these services in a standard way without knowing much on the lower level protocol exchange binding including SOAP and HTTP. This high level abstraction on the service limits human interaction and enables the automatic generation of proxies for web services, and these proxies can be static or dynamic. It allows both document and RPC - oriented messages.

16. What are the various levels of Policy Abstraction?
- Business Level
- Domain Level
- Device Level

17.What do you mean by the term flattening?
Basically,GWSDL extensions are to be transformed to WSDL.All the "extends" port types and their operations, which are brought down to a single most derived portType.This process is called "flattening" of the interface hierarchy to the most derived type.

18. **What are the lifetime properties of OGSI specification?**
- This time from which the contents of this element are valid (ogsi: goodFrom).
- This time until which the contents of this element are valid (ogsi:goodUntil).
- This time until which this element itself is available (ogsi: availableUntil).

19. What is soft-state lifetime management?
The soft-state lifetime management approach is a recommended method in the grid service life-cycle management process. Every grid service has a terminated time set by the service creator. This soft-state lifecycle is controlled by appropriate security and policy decisions of the service and the service has the authority to control this behavior.

20. Explain about MembershipContentRule:
Deriving a service from the ServiceGroup portType and utilizing the "MembershipContentRule" service data for the classification mechanisms can create a grouping concept similar to a registry. This "rule" service data is used to restrict the membership of a grid service in the group.

UNIT III - VIRTUALIZATION

1. **What is the working principle of Cloud Computing?**
The cloud is a collection of computers and servers that are publicly accessible via the This hardware is typically owned and operated by a third party on a consolidated basis in one or more data center locations. The machines can run any combination of operating systems.

2. **What is Virtualization?**

Virtualization is a foundational element of **cloud computing** and helps deliver on the value of **cloud computing**," Adams said. "**Cloud computing** is the delivery of shared **computing** resources, software or data — as a service and on-demand through the Internet.

3. **Define   Cloud   services   with   example.**

Any web-based application or service offered via cloud computing is called a cloud Cloud services can include anything from calendar and contact applications to word processing and presentations.

4. **What are the types of Cloud service development?**
   - Software as a Service
   - Platform as a Service
   - Infrastructure as a Service

5. **Explain cloud provider and cloud broker?**

Cloud Provider: Is a company that offers some component of cloud computing typically infrastructure as a service, software as a Service or Platform as a Service. It is something referred as CSP.

Cloud Broker: It is a third party individual or business that act as an intermediary between the purchase of cloud computing service and sellers of that service.

6. **Define - Private Cloud.**

The *private cloud* is built within the domain of an intranet owned by a single organization. Therefore, they are client owned and managed. Their access is limited to the owning clients and their partners. Their deployment was not meant to sell capacity over the Internet through publicly accessible interfaces. Private clouds give local users a flexible and agile private infrastructure to run service workloads within their administrative domains.

7. **Define - Public Cloud.**

A *public cloud* is built over the Internet, which can be accessed by any user who has paid for the service. Public clouds are owned by service providers. They are accessed by subscription. Many companies have built public clouds, namely Google App Engine, Amazon AWS, Microsoft Azure, IBM Blue Cloud, and Salesforce Force.com. These are commercial providers that offer a publicly accessible remote interface for creating and managing VM instances within their proprietary infrastructure.

8. **Define - Hybrid Cloud.**

A *hybrid cloud* is built with both public and private clouds; Private clouds can also support a *hybrid cloud* model by supplementing local infrastructure with computing capacity from an external public cloud. For example, the *research compute cloud* (RC2) is a private cloud built by IBM.

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9. Define anything-as-a-service?

Providing services to the client on the basis on meeting their demands at some pay per use cost such as data storage as a service, network as a service, communication as a service etc. It is generally denoted as anything as a service (XaaS).

10. What is mean by SaaS?

The software as a service refers to browser initiated application software over thousands of paid customer. The SaaS model applies to business process industry application, consumer relationship management (CRM), Enterprise resource Planning (ERP), Human Resources (HR) and collaborative application.

11. What is mean by IaaS?

The Infrastructure as a Service model puts together the infrastructure demanded by the user namely servers, storage, network and the data center fabric. The user can deploy and run on multiple VM's running guest OS on specific application**.**

12. Explain PaaS?

The Platform as a Service model enables the user to deploy user built applications onto a virtualized cloud platform. It includes middleware, database, development tools and some runtime support such as web2.0 and java. It includes both hardware and software integrated with specific programming interface.

13. List out the advantages of Cloud Computing.
• Lower IT Infrastructure Costs
• Fewer Maintenance Issues
• Lower Software Costs
• Instant Software Updates
• Increased Computing Power
• Unlimited Storage Capacity
• Increased Data Safety
• Improved Compatibility Between Operating Systems
• Improved Document Format Compatibility
• Easier Group Collaboration
• Universal Access to Documents
• Latest Version Availability
• Removes the Tether to Specific Devices

14. List out the disadvantages of Cloud Computing.
   • Requires a Constant Internet Connection
   • Doesn't Work Well with Low-Speed Connections
   • Can Be Slow
   • Features Might Be Limited
   • Stored Data Might Not Be Secure
   • If the Cloud Loses Your Data, You're Screwed

15. What is Hypervisor?

A **hypervisor** or virtual machine monitor (VMM) is a piece of computer software, firmware or hardware that creates and runs virtual machines. A computer on which a **hypervisor** is running one or more virtual machines is defined as a host machine. Each virtual machine is called a guest machine.

16. What are the types of hypervisor?
   There are two types of hypervisors:
   Type 1 (bare-metal)
   Type 2 (hosted)

Type 1 hypervisors run directly on the system hardware. They are often referred to as a "native" or "bare metal" or "embedded" hypervisors in vendor literature.

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Type 2 hypervisors run on a host operating system. When the virtualization movement first began to take off, Type 2 hypervisors were most popular. Administrators could buy the software and install it on a server they already had.

17. What are the benefits of virtualization?
Virtualization is a creation of virtual machines and to manage them from one place. It allows the resources to be shared with large number of network resources. Virtualization is having lots of benefits and they are as follows:
1. It helps in saving lots of cost and allows to easily maintaining it, in less cost.
2. It allows multiple operating systems on one virtualization platform.
3. It removes the dependency of heavy hardware to run the application.
4. It provides consolidating servers that are used for crashing of a server purpose
5. It reduces the amount of space being taken by data centres and company data.

18. What are the types of hardware virtualization?
Full virtualization: Almost complete simulation of the actual hardware to allow software, which typically consists of a guest operating system, to run unmodified Partial virtualization: Some but not all of the target environment is simulated. Some guest programs, therefore, may need modifications to run in this virtual environment.
Paravirtualization: A hardware environment is not simulated; however, the guest programs are executed in their own isolated domains, as if they are running on a separate system. Guest programs need to be specifically modified to run in this environment.

19.What are the different components used in VMWare infrastructure?
The different and major components used in VMWare infrastructure is as follows:
• VMWare infrastructure consists of the lowest layer which acts as a ESX server host.
• VMWare infrastructure also use the virtual centre server that keep tracks of all the VM related images and manage it from one point.
• VMWare infrastructure (VI) client: this allows the client to interact with user's applications that are running on VMWare.
• Web browser is used to access the virtual machines.
• License server is used to create a server that provides licensing to the applications
• Database servers are used to maintain a database.

20. What is QEMU?
QEMU is a generic and open source machine emulator and virtualizer. When used as a machine emulator, QEMU can run OS and programs made for one machine (e.g. an ARM board) on a different machine (e.g. your own PC). By using dynamic translation, Qemu achieves very good performance.

21. What is virtual Machine Cloning?
Virtual Machine Cloning is a method of creating a copy of an existing virtual machine with the same configuration and installed software as the original.The existing virtual machine is called the parent of the clone. When the cloning operation is complete, the clone is a separate virtual machine

UNIT IV - PROGRAMMING MODEL

1. What is Hadoop development?
Apache Hadoop is an open-source software framework written in Java for distributed storage and distributed processing of very large data sets on computer clusters built from commodity hardware.

2.Explain what is NameNode in Hadoop?
NameNode in Hadoop is the node, where Hadoop stores all the file location information in HDFS (Hadoop Distributed File System). In other words, NameNode is the centrepiece of an HDFS file system. It keeps the record of all the files in the file system, and tracks the file data across the cluster or multiple machines

3.Define- GT4.

Globus Toolkit 4 is a open – source toolkit developed to build grids. It provides full capabilities for sharing computing power and databases. Usage of Globus is extensive throughout the scientific community within NSF, DOE, DARPHA, IBM, NASA, and Microsoft projects.

4.Define- Map Reduce Computation.

MapReduce is designed to continue to work in the face of system failures. When a job is running, MapReduce monitors progress of each of the servers participating in the job. If one of them is slow in returning an answer or fails before completing its work, MapReduce automatically starts another instance of that task on another server that has a copy of the data. The complexity of the error handling mechanism is completely hidden from the programmer
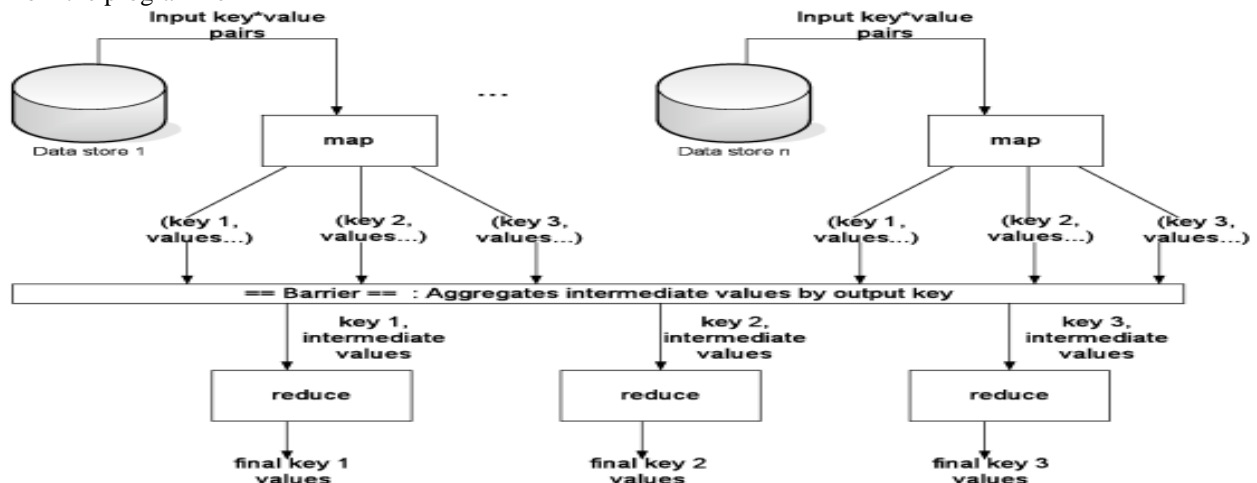
5. Mention what are the three modes in which Hadoop can be run?

The three modes in which Hadoop can be run are
- Pseudo distributed mode
- Standalone (local) mode
- Fully distributed mode

6.What are the characteristics of Cloud Programming Model?
- Cost model
- Scalability
- Fault-tolerance
- Support for specific services
- Control model
- Data model
- Synchronization mode

7.What are the phases in MapReduce Programming Model?
- Map Phase:
  Processes input key/value pair
  Produces set of intermediate pair
  map (in_key, in_value) -> list(out_key, interm_value)
- Reduce Phase:
  Combines all intermediate values for a given key
  Produces a set of merged output values
  reduce(out_key, list(interm_value)) -> list(out_value)

8. Explain what is the function of MapReducer partitioner?

The function of Map Reducer practitioner is to make sure that all the value of a single key goes to the same reducer, eventually which helps evenly distribution of the map output over the reducers

9.Mention what is distributed cache in Hadoop?

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Distributed cache in Hadoop is a facility provided by MapReduce framework. At the time of execution of the job, it is used to cache file. The Framework copies the necessary files to the slave node before the execution of any task at that node.

10.Mention what is rack awareness?

Rack awareness is the way in which the namenode determines on how to place blocks based on the rack definitions.

11.What happens when a datanode fails ?
- When a datanode fails
- Jobtracker and namenode detect the failure
- On the failed node all tasks are re-scheduled
- Namenode replicates the users data to another node

12.Define- Hadoop Scheduler.
- Job divided into several independent tasks executed in parallel
- The input file is split into chunks of 64 / 128 MB
- Each chunk is assigned to a map task
- Reduce task aggregate the output of the map tasks

13.Define- HDFS.

Hadoop File System was developed using distributed file system design. It is run on commodity hardware. Unlike other distributed systems, HDFS is highly fault tolerant and designed using low-cost hardware. HDFS holds very large amount of data and provides easier access. To store such huge data, the files are stored across multiple machines.

14.What are the features of HDFS?
- It is suitable for the distributed storage and processing.
- Hadoop provides a command interface to interact with HDFS.
- The built-in servers of name-node and data-node help users to easily check the status of cluster.
- Streaming access to data in the file system.
- HDFS provides file permissions and authentication.

15.Sketch the HDFS Architecture.

HDFS Architecture
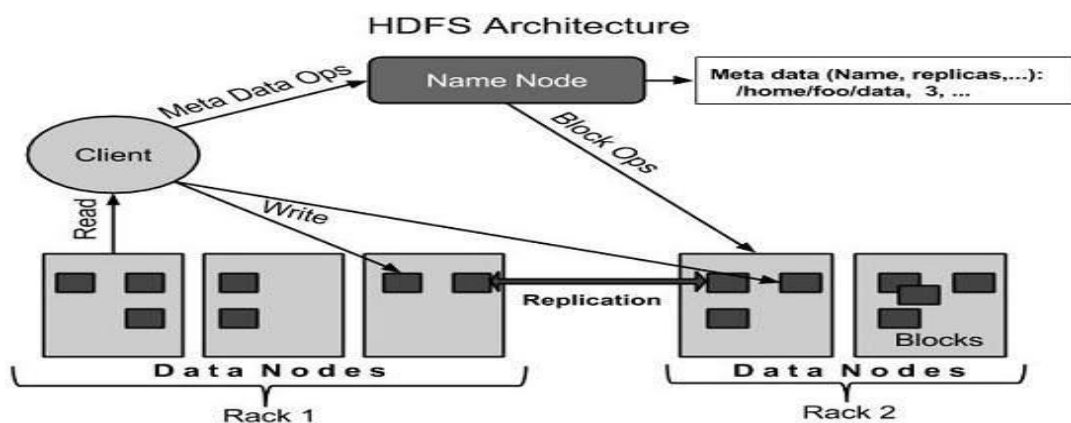
16.What is Cloud Dataflow Programming Model?

The Dataflow programming model is designed to simplify the mechanics of large-scale data processing. When you program with a Dataflow SDK, you are essentially creating a data processing job to be executed by one of the Cloud Dataflow runner services.

This model lets you concentrate on the logical composition of your data processing job, rather than the physical orchestration of parallel processing. You can focus on what you need your job to do instead of exactly how that job gets executed.

17.What is Java Cloud service?

Oracle Java Cloud Service is a subscription-based, self-service, reliable, scalable, and elastic enterprise-grade cloud platform that enables businesses to securely develop and deploy Java applications.

- Dedicated virtual machines for running your entire WebLogic Server cluster.
- Pre-configured WebLogic Server software, with your choice of the 11g or 12c version.
- Choice of virtual machine size (virtual cores, memory), as well as the size of the WebLogic cluster.
- Self-managed, with fully automated cloud tooling for administrative and lifecycle operations, such as patching, scaling, and backup.
- Fully automated, one-click, point-in-time restore for the entire service.

18.What is AIM?

The most-used instant messaging program is AOL Instant Messenger (www.aim.com), also known as AIM. AIM supports all manner of special features in addition to basic text messaging. The users get file sharing, RSS feeds, group chats, ability to text message to and from mobile phones, voice chat, video chat, and even a mobile client and can also enhance the basic AIM experience with a variety of official and user-created plug-ins.

19.Define- Multi-tenancy.

Multi-tenancy can be defined as a principle in software architecture, where a single instance of a vendor's offering runs on the vendor's servers, serving multiple client organizations (tenants). Often these tenants will pay a fee for this.

In practice, multi-tenancy allows a cloud provider to provide a service to organizations that have users of their own. Of course, in certain cases the tenant could have only 1 user; the important point is that the cloud provider has taken the tenant concept into account and provided e.g. access based on the tenant concept, billing based on the tenant concept, etc.

20.Define- GFS.

Google File System (**GFS** or GoogleFS) is a proprietary **distributed file system** developed by Google for its own use.

It is designed to provide efficient, reliable access to data using large clusters of commodity hardware. A new version of the Google File System is codenamed Colossus which was released in 2010.

21.Define- OGF.

OGF is an open global community committed to driving the rapid evolution and adoption of modern advanced applied distributed computing, including cloud, grid and associated storage, networking and workflow methods.

OGF is focused on developing and promoting innovative scalable techniques, applications and infrastructures to improve productivity in the enterprise and within the international research, science and business communities.

UNIT V - SECURITY

1.What are the functions in Grid Security Model?
- Multiple security mechanisms
- Dynamic creation of services
- Dynamic establishment of trust domains

2. What are OGSA security services?
- Credential processing service
- Authorization service
- Credential Conversion service
- Identity Mapping service
- Audit

3.What are the high-level services included in Globas toolkit?
- Globus Resource Allocation Manager(GRAM)
- Grid Security Infrastructure(GSI)
- Information Services

4.What are the most common Gt3 handlers?
- Authentication service Hanlder
- WS Security Handler
- Authorization Handler
- X509 Sing Handler
- GSS Handler

5. Define- GSI.
The **Grid Security** Infrastructure (GSI), formerly called the Globus **Security** Infrastructure, is a specification for secret, tamper-proof, delegatable communication between software in a **grid** computing environment. **Secure**, authenticatable communication is enabled using asymmetric encryption.

6. What are the high level grid security requirement aspects?
- Authentication
- Authorization
- Delegation
- Message integrity
- Single logon
- Confidentiality
- Privacy
- Policy exchange
- Credential life span and renewal
- Secure logging
- Assurance
- Manageability

7. What is CISCO connected grid security principles?
Cisco integrates security as a fundamental building block of any network architecture—whether for the field area network, transmission and substation network, or the intra-control center tier. The primary principles behind Cisco Connected Grid security include:
- Access control
- Data integrity, confidentiality, and privacy
- Threat detection and mitigation
- Device and platform integrity

8. What are the risks of storing data in the Cloud?
- Reliability
- Security
- User error
- Access problems

9. What are the factors to identify the threats in cloud?
- Failures in Provider Security
- Attacks by Other Customers
- Availability and Reliability Issues
- Legal and Regulatory Issues
- Perimeter Security Model Broken
- Integrating Provider and Customer Security Systems

10. What are the phases in data security life cycle?

Create: Creation is the generation of new digital content, or the alteration/updating of existing content.
Store: Storing is the act committing the digital data to some sort of storage repository, and typically occurs nearly simultaneously with creation.
Use: Data is viewed, processed, or otherwise used in some sort of activity.
Share: Information is made accessible to others, such as between users, to customers, and to partners
Archive: Data leaves active use and enters long-term storage.
Destroy: Data is permanently destroyed using physical or digital means (*e.g.,* cryptoshredding).

11. Define- DLP.

Data Loss Prevention (DLP) is defined as: Products that, based on central policies, identify,   monitor, and protect data at rest, in motion, and in use, through deep content analysis.

DLP is typically used for content discovery and to monitor data in motion using the following options:

- **Dedicated appliance/server:** Standard hardware placed at a network chokepoint between the cloud environment and the rest of the network/Internet., or within different cloud segments.
- **Virtual appliance**
- **Endpoint agent**
- **Hypervisor-agent**: The DLP agent is embedded or accessed at the hypervisor level, as opposed to running in the instance.

12. What is PaaS Encryption?

Since PaaS is so diverse, the following list may not cover all potential options:

- **Client/application encryption:** Data is encrypted in the PaaS application, or the client accessing the platform.
- **Database encryption:** Data is encrypted in the database using encryption built in and supported by the database platform.
- **Proxy encryption:** Data passes through an encryption proxy before being sent to the platform.
-

13. Define- Database Activity Monitoring (DAM).

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Database Activity Monitors capture and record, at a minimum, all Structured Query Language (SQL) activity in real time or near real time, including database administrator activity, across multiple database platforms; and can generate alerts on policy violations.

14. What are the two aspects involved in GRAM?

- Job submission- a user starts the job scheduling with the creation of a managed job service.
- Resource management – a client knows about the master host environment and the master managed factory service.

15. What are the two kinds of lifecycle model associated with state data recovery?

- Persistent lifecycle model.
- Transient lifecycle model.

16. Write the combination of Globus GT3 toolkit?

- o GT3 core.
- o Base services
- o User- defined services.

17. What are the two aspects involved in GRAM?

- Job submission- a user starts the job scheduling with the creation of a managed job service.
- Resource management – a client knows about the master host environment and the master managed factory service.

18. What is a GT3 core?

It provides a framework to host the high-level services.

The core consists of OGSI reference implementation, security infrastructure, and System level services.

19. What are the major components of default server side framework?

Web service engine provided by Apache AXIS framework. The GT3 software uses the Apache AXIS framework to deal with normal web services.

Globus container framework. The GT3 software provides a container to manage stateful web service through a unique instance handle, instance repository, and lifecycle management.

20. Write notes on Grid container?

The Globus container model is derived from the J2EE managed container model, where the components are free from complex resource manageability.

- Lightweight service introspection and discovery.
- Dynamic deployment and soft-state management of stateful grid services.

21. What are the two levels of security available in GT3?

- Transport-level security-based on GSI security mechanism.
- Message-level security-implemented at the SOAP message level.

22. What are the treatments to the operation involved in service activation?

- Activate utilizing the lazy creation mechanism.
- Activation on service startup.

23. What are the problems with the operation providers?

- Due to the unavailability of multiple inheritances in java, service developers utilize the default interface hierarchy, as provided by the framework.
- Some of the behaviors implemented by the aforementioned classes are specific to the GT3 container.

- Dynamic configurations of service behaviors are not possible.

24. What are the expression evaluators supported in GT3?
- Service Data Name Evaluator.
- Service Data Name Set Evaluator.
- Service Data Name Delete Evaluator.
- Service Data XPath Evaluator.

25. What are the two different message-level authentication mechanisms provided by GT3 framework?
- GSI Secure Conversation- a secure context is established between the client and the service.
- GSI XML Signature- a message is signed with a given set of credentials.

26. What are the three ways available to create and add service data to service dataset?
- Gets the service data wrapper class from the service data set using the QName of the service data element as defined in WSDL Create the value for that service data element.
- Update the service data set with service data wrapper and the new value.

27. What are the steps involved in creating SDE?
- Create a new SDE by calling the create method of the service instance's service data set with a unique name or QName.
- Set a value for the SDE. The value of the SDE of type My Service Data type. Set the initial value of My Service Data Type.
- Add the SDE to the service data set.

28. What are the most common GT3 security handlers?
- Authentication
- Service Handler
- WS security Handler
- Security Policy Handler
- Authorization Handler
- X509sign Handler
- GSS Handler

29. What are the client side security handlers?
- X509SignHandler SecContextHandler
- GSSHandler
- WSSecurityClientHandler

PART - B
UNIT – 1
1) Explain in detail about virtual organization. (16)
2) Write about the scope of grid computing in business areas. (16)
3) Explain some of the grid application and their usage patterns. (16)
4) Write short notes on. (16)
    a) Schedulers
    b) Resource broker
    c) Load balancing
    d) Grid portals
5) What are the data and functional requirements of grid computing? (16)
6) Explain briefly about grid infrastructure. (16)
7) Describe in detail about the Technologies for network based systems? (16)

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UNIT – II

1) Write short notes on Open Grid Service Architecture. (16)
2) Explain in detail, the functional requirements of OGSA. (16)
3) Explain Practical & Detailed view of OGSA/OGSI. (16)
4) Explain in detail, OGSA services**.**(16)
5) Describe about the relation of grid architecture with other distributed technologies.(16)
6) What are the third generation initiatives of grid computing?
7) Discuss briefly about organization building and using grid based solution to solve their computing data and network requirements.

UNIT III

1) Write short notes on cloud deployment model. (16)
2) Explain in detail, categories of cloud. (16)
3) Explain in detail, pros and cons of cloud. (8)
4) Explain in detail, different implementation level of virtualization? (16)
5) Write short notes on OS level virtualization. List the pros and cons of OS level virtualization. (16)
6) Explain in detail, the virtualization of CPU, Memory and I/O devices. (16)
7) Write short notes on virtual clusters. (8)
8) Explain in detail, the virtualization for data center automation. (16)

UNIT IV

1) Explain in detail, the architecture and working principle of MapReduce?
2) Explain in detail, dataflow and control flow of MapReduce?
3) Write short notes on iterative MapReduce in detail?
4) Explain in detail, the architecture of MapReduce in Hadoop?
5) Explain in detail, the programming the Google App Engine?
6) Explain in detail, the Architecture of Google File System?
7) Explain in detail, the structure of BigTable data model?
8) Explain in detail, the programming on Amazon EC2?
9) Explain in detail, the architecture of Amazon EC2?
10) Explain in detail, the Microsoft Azure programming support?

UNIT V

1) Explain the Security challenges in cloud computing in detail?
2) Explain the security architecture in detail?
3) Write short notes on,
    a. Security governance
    b. Security monitoring
    c. Risk management
4) Explain the Secure Software Development Life Cycle?
5) Explain in detail about Software-as-a-Service security?
6) Explain the application security in detail?
7) Explain the data security and virtual machine security in detail?
8) Explain the identity management and access control in detail?

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UNIVERSITY QUESTION PAPERS

B.E. DEGREE EXAMINATION MAY 2011
Computer Science and Engineering
CS2254 Cloud Computing

PART - A (10 x 2 = 20 MARKS)
ANSWER ALL THE QUESTIONS

1. What are the properties of Cloud Computing?
2. What are the advantages of cloud services?
3. List the companies who offer cloud service development?
4. What is pre cloud computing?
5. Give the various schedules in Collaborating on schedule.
6. What are the modules in the Conference.com?
7. Give some online to-do list application.
8. Who should use a Web-Based Word Processor?
9. List the web-based spreadsheet applications
10. What is web conferencing?

PART - B (5 x 16 = 80 MARKS)
ANSWER ALL THE QUESTIONS

11.	a.	(i)	Discuss about the Pros and Cons of Cloud Computing.	(8)
		(ii)	Explain briefly about who get benefits from Cloud Computing	(8)
			(OR)	
	b.	(i)	Explain the types of Cloud service development in detail	(8)
		(ii)	Explain the architecture of Cloud computing in detail.	(8)
12.	a.	(i)	What are the collaboration schedules in communicating across the community?	(8)
		(ii)	Explain the activities on cloud computing for the corporation.	(8)
			(OR)	
	b.		Explain in detail about Centralizing email communication.	(16)
13.	a.	(i)	Discuss about Collaborating on calendars	(8)
		(ii)	How to explore on line scheduling and planning. Explain with example.	(8)
			(OR)	
	b.	(i)	Explain in detail about collaborating on word processing,	(8)
		(ii)	Explain collaborating on event management	(8)
14.	a.	(i)	How to create groups on social networks? Explain with example.	(8)
		(ii)	Explain about evaluating web conference tools.	(8)
			(OR)	
	b.	(i)	Explain in detail about Evaluating on line groupware.	(8)
		(ii)	Explain about evaluating web conference tools.	(8)
15.	a.	(i)	Discuss about the online photo editing applications.	(8)
		(ii)	Explain about the photo sharing communities.	(8)
			(OR)	
	b.		Explain in detail about understanding the cloud storage.	(16)

CS6703 GRID AND CLOUD COMPUTING

GRT INSTITUTE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

B.E. DEGREE EXAMINATION MAY 2012
Computer Science and Engineering
CS2254 Cloud Computing

PART - A (10 x 2 = 20 MARKS)
ANSWER ALL THE QUESTIONS

1.   Draw the architecture of Cloud
2.   Define Cloud services with example.
3.   Who get benefits from Cloud Computing?
4.   What are the types of Cloud service development?
5.   How to manage the web based projects?
6.   What is virtual community?
7.   List the web-based presentation programs.
8.   What is Hunt calendar?
9.   How Online Databases Work?
10. List some of the web conferencing tools.

PART - B (5 x 16 = 80 MARKS)
ANSWER ALL THE QUESTIONS

11.	a.	(i)	Explain the Cloud service development.	(8)
		(ii)	Explain briefly about who get benefits from Cloud Computing	(8)
			(OR)	
	b.	(i)	How to discover cloud service development services and tools?	(8)
		(ii)	Explain collaboration to cloud.	(8)
12.	a.	(i)	Explain Collaborating on Group Projects and Events.	(8)
		(ii)	Explain the activities on cloud computing for the corporation.	(8)
			(OR)	
	b.	(i)	What are the collaboration schedules in communicating across the community?	(8)
		(ii)	Explain in detail about Centralizing email communication.	(8)
13.	a.	(i)	Explain in detail about collaborating on spreadsheets.	(8)
		(ii)	Discuss about Collaborating on Schedules.	(8)
			(OR)	
	b.	(i)	Explain collaborating on contact management.	(8)
		(ii)	How to explore on line scheduling and planning. Explain with example.	(8)
14.	a.	(i)	Explain about Evaluating instant messaging.	(8)
		(ii)	Explain in detail about Evaluating on line groupware.	(8)
			(OR)	
	b.	(i)	How to create groups on social networks? Explain with example.	(8)
		(ii)	Explain about evaluating web mail services	(8)
15.	a.	(i)	Explain about online bookmarking services.	(8)
		(ii)	Discuss about the online file storage and sharing services.	(8)
			(OR)	
	b.	(i)	Explain in detail about understanding the cloud storage.	(8)

CS6703 GRID AND CLOUD COMPUTING

(ii)   Discuss about the online photo editing applications.   (8)

CLOUD COMPUTING
IMPORTANT QUESTIONS

1 Explain any six benefits of Software as Service in Cloud computing? 12M

2 List the different cloud applications available in the market? Briefly explain the scenarios/situations of "when to not use clouds". 12M

3 a) Explain the tasks performed by Google applications engine? 6M b) Write a short note on IBM offerings towards Cloud computing? 6M

4 Explain the different operational and economical benefits of using clouds? 12M

5 a) Describe any six design principles of Amazon S3 Cloud computing model? 6M

b) What is REST in Web services? List the different benefits of REST. 6M

6 a) What is SaaS in Cloud computing? Explain different categories of SaaS? 6M

b) List the prevalent companies and their offerings towards software plus services via Cloud computing? 6M

7 What is the need of virtualization? Define Server virtualization, Application virtualization, Presentation Virtualization. 12M

8 Discuss the various migration issues of the organization towards Clouds? 12M

SECTION - I

QI) a) Define Cloud computing, Enlist and explain essential characteristics of cloud computing [8]

b) Explain the services provided by the Amazon infrastructure cloud from a user perspective. [8]

c)What is self service provisioning? [2]

OR

Q2) a) What is cloud computing? Enlist and explain three service models, and four deployment models of cloud computing. [8]

b) Explain a user view of Google App Engine with suitable block schematic.[8]

c) Explain in brief, how cloud helps reducing capital expenditure? [2]

Q3) a) What is the difference between process virtual machines, host VMMs and native VMMs ?   [8]

b) Enlist and explain some of the common pitfalls that come with virtualization. [8]

OR

Q4) a) What is the fundamental differences between the virtual machine as perceived by a traditional operating system processes and a system VM? [8]

b) Compare the SOAP and REST paradigms in the context of programmatic communication between applications deployed on different cloud providers, or between cloud applications and those deployed in -house. [8]

Explain the architecture of cloud file systems (GFS, HDFS). [8]

Explain with suitable example, how a relational join could be executed in parallel using MapReduce. [8]

Explain how Big tables are stored on a distributed file system such as GFS or HDFS.[8]

Explain with suitable example the MapReduce model. [8]

SECTION – II

Why Cloud Computing brings new threats [6]

What is secure execution environment and communication in cloud? [6]

 Explain different threats and vulnerabilities specific to virtual machines. [6]

OR

Explain the two fundamental functions, identity management and access control, which are required for secure cloud computing [7]

Explain risks from multi-tenancy, with respect to various cloud environments. [7]

What is trusted cloud computing? [4]

Explain issues in cloud computing with respect to implementing real time application over cloud platform. [8]

Enlist and explain the principal design issues that are to be addressed while designing a QoS-aware distributed (middleware) architecture for cloud. [8]

OR

What is quality of service (QoS) monitoring in a cloud computing? [8] Enlist and explain different issues in inter-cloud environments. [8]

Explain conceptual representation of the Eucalyptus Cloud. Explain in brief the components within the Eucalyptus system. [8]

What is Nimbus? What is the main way to deploy Nimbus Infrastructure? What is the difference between cloudinit.d and the Context Broker? [8]

OR

What is Open Nebula Cloud? Explain main components of Open Nebula. [8]

Explain Xen Cloud Platform (XCP) with suitable block diagram. [8]

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 80306

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Seventh Semester

Computer Science and Engineering

CS 6703 — GRID AND CLOUD COMPUTING

(Common to Seventh Semester Information Technology)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Bring out the differences between private cloud and public cloud.

2. Highlight the importance of the term "cloud computing".

3. List the requirements of resource sharing in a grid.

4. What are the security concerns associated with the grid?

5. Give the role of a VM.

6. Why do we need a hybrid cloud?

7. Name any four services offered in GT4.

8. What are the advantages of using Hadoop?

9. Mention the importance of Transport Level Security.

10. Discuss on the application and use of identity and access management.

PART B — (5 × 16 = 80 marks)

11. (a) Illustrate the architecture of virtual machine and brief about the operations.

Or

(b) Write short notes on :

(i) cluster of cooperative computers. (8)

(ii) service oriented architecture. (8)

12. (a) With a neat sketch, discuss the OGSA framework.

Or

(b) Explain the data intensive grid service models with suitable diagrams.

13. (a) List the cloud deployment models and give a detailed note about them.

Or

(b) Give the importance of cloud computing and elaborate the different types of services offered by it.

14. (a) Draw and explain the global toolkit architecture.

Or

(b) Give a detailed note on Hadoop framework.

15. (a) Explain trust models for grid security environment.

Or

(b) Write in detail about cloud security infrastructure.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 71692

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Seventh Semester

Computer Science And Engineering

CS 6703 — GRID AND CLOUD COMPUTING

(Common to Information Technology)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Tabulate the differences between high performance computing and high throughput computing.

2. Give the basic operations of a VM.

3. What do you understand by the term 'data intensive'?

4. Define "OGSA".

5. Mention the characteristic features of the cloud.

6. Summarize the differences between PaaS and SaaS.

7. Write the significant use of GRAM.

8. Name the different modules in Hadoop framework.

9. What are the various challenges in building the trust environment?

10. Write a brief note on the security requirements of a grid.

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PART B — (5 × 16 = 80 marks)

11. (a) Brief the interaction between the GPU and CPU in performing parallel execution of operations. (16)

Or

(b) Illustrate with a neat sketch, the grid computing infrastructure. (16)

12. (a) Write a detailed note on OGSA security models. (16)

Or

(b) Explain how migrations of grid services are handled. (16)

13. (a) Discuss how virtualization is implemented in different layers. (16)

Or

(b) What do you mean by data centre automation using virtualization? (16)

14. (a) Discuss MAPREDUCE with suitable diagrams. (16)

Or

(b) Elaborate HDFS concepts with suitable illustrations. (16)

15. (a) Write detailed note on identity and access management architecture. (16)

Or

(b) Explain grid security infrastructure. (16)

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CS6703 GRID AND CLOUD COMPUTING

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CS6704   **RESOURCE MANAGEMENT TECHNIQUES**   **L T P C 3 0 0 3**

UNIT I   **LINEAR PROGRAMMING**   **9**

Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis.

UNIT II   **DUALITY AND NETWORKS**   **9**

Definition of dual problem – Primal – Dual relationships – Dual simplex methods – Post optimality analysis – Transportation and assignment model - Shortest route problem.

UNIT III   **INTEGER PROGRAMMING**   **9**

Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.

UNIT IV   **CLASSICAL OPTIMISATION THEORY**   **9**

Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

UNIT V   **OBJECT SCHEDULING:**   **9**

Network diagram representation – Critical path method – Time charts and resource leveling – PERT.

TOTAL: 45 PERIODS

TEXT BOOK:
1. H.A. Taha, "Operation Research", Prentice Hall of India, 2002.

REFERENCES:
1. Paneer Selvam, „Operations Research‟, Prentice Hall of India, 2002
2. Anderson „Quantitative Methods for Business‟, 8th Edition, Thomson Learning, 2002.
3. Winston „Operation Research‟, Thomson Learning, 2003.
4. Vohra, „Quantitative Techniques in Management‟, Tata Mc Graw Hill, 2002.
5. Anand Sarma, „Operation Research‟, Himalaya Publishing House, 2003.

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UNIT-I LINEAR PROGRAMMING
PART-A

1. What are the various types of models?
  - ➢ Iconic (or) physical models
  - ➢ Analogue (or) schematic models
  - ➢ Symbolic (or) mathematical models.

2. What is an analogue model?

Analogue model can represent dynamic situation. They are analogues to the characteristic of the system under study. They use one set of properties to represent some other set of properties of the system. After the model is solved the solution is reinterpreted in terms of the original system.

3. What is an iconic model?

Iconic model are the pictorial representation of real systems and have the appearance of the real structure. Examples such models are city maps, houses, blue prints etc.

4. Name some characteristics of a good model.
  - ➢ It should be simple and coherent.
  - ➢ It is should be open to parametric type of treatment.
  - ➢ There should be less number of variable.
  - ➢ Assumption made in the model should be clearly mentioned and should be as small as possible.

5. Explain the principles of modeling?
  - ➢ Models should be validated prior to implementation.
  - ➢ Models are only aids in decision making.
  - ➢ Models should not be complicated. They should be as simple as possible.
  - ➢ Models should be accurate as possible.

6. What do you mean by a general LPP?

The general LPP is given by

$$Max\ (or)\min Z = C_1X_1 + C_2X_2 + C_3X_3 + C_4X_4 + ... + C_nX_n -----(1)$$

Subject to

$$a_{11}x_1 + a_{12}x_2 + ... + a_{1n}x_n (\leq=\geq)b_1$$
$$a_{21}x_1 + a_{22}x_2 + ... + a_{2n}x_n (\leq=\geq)b_2$$
$$..$$
$$..$$
$$a_{m1}x_1 + a_{m2}x_2 + ... + a_{mn}x_n (\leq=\geq)b_n$$

$$\left. \right\} --------(2)$$

$$X_1, X_2, X_3 ....X_n \geq 0 --------(3)$$

  (1) is called the objective function.
  (2) is the constraints
  (3) is called non-negativity constraints.

7. Define a feasible region?

A region in which all the constraints are satisfied simultaneously is called a feasible region.

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8. Define a feasible solution.

Any solution to a LPP which satisfies the non-negativity restrictions of the LPP is called the feasible solutions.

9. What is a redundant constraint?

A constraint that does not from boundary of feasible region and has impact on the solution of the problem, remodel of which does not alter the solution is called redundant constraints.

10. Define optimal solution.

Any feasible solution which optimizes [minimizes (or) maximizes] the objective function is called its optimal solution.

11. Define basic solution.

Given a system of m linear equations with n variables, any solution which is obtained by solving for 'm' variables keeping the remaining (n-m) variables as zero is called a basic solution.

12. Define degenerate solution.

A basic feasible solution is said to be degenerate if one or more basic variables are zero.

13. Define unbounded solutions.

If the value of the objective function Z can be increased (or) decreased indefinitely such solutions are called unbounded solutions.

14. What do you mean by canonical form of a LPP?

In canonical if the objective functions is of maximization, then all the constraints other than non negativity conditions are $\leq$ type. Similarly if the objective function is of minimization then all the constraints are $\geq$ type.

15. What are the slack and surplus variables?

The non negative variable which is added to LHS of the constraints to convert the inequality $\leq$ into an equation is called slack variables $\sum_{j=1}^{n} a_{ij}x_i + s_i = b_i$. Where s_i are called slack variable

The non negative variable which is subtracted to LHS of the constraints to convert the inequality $\geq$ into an equation is called surplus variables $\sum_{j=1}^{n} a_{ij}x_i - s_i = b_i$. Where s_i are called surplus variable

16. What is key column and key row?
- ➢ Key column is the column which gives the entering variable column
- ➢ Key row is the row which gives the leaving variable row.

17. What are the methods used to solve an LPP involving artificial variables.
- ➢ Big M-method (or) penalty cost method
- ➢ Two phase simplex method

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18. Define artificial variables.
Any non-negative variable which is introduced in the constraint in order to get the initial basic feasible solution is called artificial variable.

19. When does an LPP possess a pseudo optimal solution?
An LPP possess a Pseudo-optimal solution if at least one artificial variable is in the basis at positive level even though the optimal conditions are satisfied.

20. What is degeneracy?
The concept of obtaining a degenerate basic feasible solution in a LPP is known as degeneracy.

UNIT-II DUALITY AND NETWORKS
PART-A

1. What dual of LPP.
For every LPP there is a unique LPP associate with it involving the same data and closely related optimal solution. The original problem is then called the primal problem while the other is called its dual problem.

2. What are the advantages of duality?
  ➢ If primal contains a large number of constraints and a smaller number of variables, then the process Of computations can be considerably reduced by converting it into the dual problem.
  ➢ Since the optimal solution to the objective function is the same for both primal and dual, a dual solution can be used to check the accuracy of the primal solution.

3. State the feasibility condition in dual simplex method.
In dual simplex method in finding the variable which enters the basis we find $\max\left\{Z_j - C_j / a_{ik}, a_{ik} < 0\right\}$. If there is no ratio with negative denominator then the procedure does not have a feasible solution.

4. Find the dual of the following LPP.
$$\max Z = 3x_1 - x_2 + x_3$$
$$subject\ to\ \ 4x_1 - x_2 \leq 8$$
$$8x_1 + x_2 + 3x_3 \geq 12$$
$$5x_1 - 6x_3 \leq 13$$
$$x_1, x_2, x_3 \geq 0$$

5. Write the dual of the following primal LPP
$$\max Z = x_1 + 2x_2 + x_3$$
$$subject\ to\ \ 2x_1 + x_2 - x_3 \leq 2$$
$$-2x_1 + x_2 - 5x_3 \geq -6$$
$$4x_1 + x_2 + x_3 \leq 6$$
$$x_1, x_2, x_3 \geq 0$$

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6. What do you understand by transportation problem?

We transport a commodity from the source to a destination in such a way that the total transportation cost is minimum.

7. Test any 3 approaches used with transportation problem for determining the stating solution.
- North-West corner rule
- Least cost method(matrix minima)
- Vogel's approximation method

8. Define balanced transportation problem?

Any transportation problem is said to be balanced if $\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$

(i.e) If the total supply = total demand

9. What do you mean by degeneracy in transportation problem?

If the number of occupied cells in a $m \times n$ transportation is less than $m+n-1$ then it is called a degenerate in transportation.

10. How do you convert an unbalanced transportation problem into a balanced one?

The unbalanced transportation can be converted into a balanced on by adding a dummy row with cost zero and the excess demand is interred as a rim requirement if total supply is less than total demand. On the other hand if the total supply is greater than total demand we introduced a dummy column with cost zero and the excess supply is entered as a rim requirement for the dummy destination.

11. Define unbalanced Transportation problem?

Any Transportation problem is said to be unbalanced if *total* sup *ply* $\neq$ *total demand*

$$\sum_{i=1}^{m} a_i \neq \sum_{j=1}^{n} b_j$$

12. What is an Assignment problem?

The problem of assiging the number of jobs to equal number of facilities (machines or persons or destination) at a minimum cost or maximum profit is called an Assignment problem.

13. Give two applications of Assignment problem?
- If 'n' jobs have to be assigned to 'n' workers or machines with unit time of performing the job we can use assignment model to get minimum cost.
- Travelling salesman problem. (Ie) a salesman has to visit a number of cities not visiting the same city twice and return to the starting place.

14. Define balanced Assignment problem?

If the number of rows is equal to the number of column in the cost matrix of the Assignment problem is called an Assignment problem.

15. State the difference between Transportation and Assignment problem?

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Transportation problem	Assignment problem
1. The cost matrix is not necessarily a square matrix	The cost matrix is must be square matrix
2. Supply and demand at any source at any destination may be positive quantity	Supply and demand at any source at any destination will be 1
3.The allocation X_{ij} can take any positive values satisfies the rim requirements.	X_{ij} will be take only two possible values 1 or 0

16. When is an Assignment problem said to be unbalanced?

If the cost matrix or profit matrix is not a square matrix then the problem is said to be unbalanced Assignment problem.

17. Write the mathematical formulation of Assignment problem?

The Assignment problem can be expressed as *Minimize* $Z = \sum_{i=1}^{n} \sum_{j=1}^{n} C_{ij} X_{ij}$

C_{ij} is the cost of assigning i^{th} machine to the jth job subject to

$$X_{ij} = \begin{cases} 1 \ if \ i^{th} \ machine \ is \ assigned \ to \ the \ j^{th} \ job \\ 0 \ if \ not \end{cases}$$

UNIT-III INTEGER PROGRAMMING
PART-A

1. What do you mean by integer programming problem?

An LPP in which some or all of the variables in the optimal solution are restricted to assume non-negative integer values is called an integer programming problem.

2. Define a pure integer programming problem?

In a LPP if all the variables in the optimal solution are restricted to assume non negative integer values, then it is called a pure integer programming problem.

3. Define mixed integer programming problem?

In an LPP if only some of the variables in the optimal solution are restricted to assume non negative integer values while the remaining variables are free to take any non negative values then it is called a mixed integer programming problem.

4. Differentiable between pure and mixed integer programming problem?

In a pure IPP all the variables in the optimal solution are restricted to non negative integer values where as the mixed integer programming problem only some of the variable in the optimal solution are restricted to assumed non negative integer values.

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5. Give some applications of integer programming problem?
   ➢ In product mix problem
   ➢ Sequencing and routing problem
   ➢ All allocations problem involving the allocation of goods, men and machines.

6. What are the methods used in solving Integer programming problem?
   There are 2 methods , namely
   ➢ Cutting method (Gomary's cutting plane algorithm)
   ➢ Search method (Branch and Bound technique)

7. Explain Gomarian constraint or fractional cut constraint.
   A new constraint introduced to the problem such that the new set of feasible solution includes all the original feasible integer solutions but does not include the optimum non integer solution initially found. This new constraint is called fractional cut or Gomarian's constraint

8. Where is Branch and Bound method used?
   This method is an enumeration method which is used when all the feasible integer points are not enumerated.

9. What is the fractional part of the negative number $-\dfrac{98}{19}$?

   The fractional part of the negative number $-\dfrac{98}{19}$ is given by $\dfrac{16}{19}$. The number can be

expressed as $-\dfrac{98}{19} = -6 + \dfrac{16}{19}$

10. What is the fractional part of $-\dfrac{2}{3}$?

   The fractional part can be expressed as $-\dfrac{2}{3} = -1 + \dfrac{1}{3}$. The fractional part of $-\dfrac{2}{3}\ is\ \dfrac{1}{3}$.

11. Explain the importance of Integer programming problem?
   All the decision variables were allowed to take any non negative real values as it is quite possible and appropriate, to have fractional values in many solutions and which are meaningless in the content of the actual decision problem. This is the main reason why IPP is so important for marginal decisions.

12. What is dynamic programming?
   Many decisions making problems involve a process that takes place in multiple stages in such a way that at each stage, the process is dependent on the strategy chosen. Such types of problems are called dynamic programming problem.

13. Define the following terms in dynamic programming: Stage, State, State variables.
   STAGE: Stage may be defined as the portion of the problem that possesses a set of mutually   exclusive alternatives from which the best alternatives is to be selected.
   STATE: States are various possible conditions of the system at a stage of the problem.
   STATE VARIABLE: The current situation of the system at a stage is described by a set of variable called state variables.

14. Give a few applications of dynamic programming problem.

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> ➢ It is used to determine the optimal combinations of adverting media and the frequency of adverting.
> ➢ Spare part level determination to guarantee high efficiency of utilization of expensive equipment
> ➢ It has been used to determine the inventory level and for formulating the inventory recording.
> ➢ Other areas of applications scheduling methods Markovin decision, decision models, infinite stage system, probabilistic decision problems etc.

15. State Bellman's principle of optimality.

An optimal policy has the property that whatever be the initial state and initial decisions the remaining decisions must constitute an optimal policy for the state resulting from the first decisions

UNIT-IV
CLASSICAL OPTIMSATION THEORY

1. What is non linear programming problem?

Non linear programming problem is an extension of linear programming. The objective function may be non linear, but the set of constraints may be linear or non linear. Such problem are called as non linear problem.

2. What is the use of classical optimization theory?

Classical optimization theory uses differential calculus to determine points of maxima and minima for unconstrained and constrained functions.

3. What are the methods of equality constraints?
> ➢ Jacobian method
> ➢ Lagrangean method

4. Write the condition for maximum of the function?

A function $f(x)$ is a maximum at $X_0 = (X_1^0, X_2^0, ...X_j^0......X_n^0)$ if $f(X_0 + h) \le f(X_0)$ for all h.

5. Write the condition for minimum of the function?

A function $f(x)$ is a minimum at $X_0 = (X_1^0, X_2^0, ...X_j^0......X_n^0)$ if $f(X_0 + h) \ge f(X_0)$, for all h

6. State the order of convergence and convergence condition for Newton's Raphson method .

The order of convergence is 2. Condition for convergence is $|f(x)f''(x)| < |f'(x)|^2$

7. Write the iterative formula of Newton's Raphson method.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

8. Show that the N.R formula to find $\sqrt{a}$ can be expressed in the form

$$x_{n+1} = \frac{1}{2}\left(x_n + \frac{a}{x_n}\right),\ \text{n = 0, 1, 2, ...}$$

If $x = \sqrt{a}$,then $x^2 - a = 0$ is the equation to be solved.

Let $f(x) = x^2 - a$, $f'(x) = 2x$

By N.R rule, if x_n is the nth iterate,

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$= x_n - \frac{x_n^2 - a}{2x_n}$$

$$= \frac{2x_n^2 - x_n^2 + a}{2x_n}$$

$$= \frac{x_n^2 + a}{2x_n}$$

$$x_{n+1} = \frac{1}{2}\left(x_n + \frac{a}{x_n} \right), \quad n = 0, 1, 2,\ldots$$

9. What is mean by unconstrained optimization?

An unconstrained optimizations problem is one where you only have to be concerned with the objective function you are trying to optimize

10. Write the methods unconstrained optimization?

- **FUNCTION OF ONE VARIABLE**
  - ➤ General ideas of optimization
  - ➤ First and second order conditions
  - ➤ Local and global extremum
    FUNCTIONS OF SEVERAL VARIABLES
      - ➤ First and second order conditions
      - ➤ Local and global extremum

11. Define Hessian matrix

· $f(\mathbf{x})$ is a C^2 function of n variables,

$$\mathbf{H}(\mathbf{x}) \equiv \nabla^2 f(\mathbf{x}) = \begin{bmatrix} \dfrac{\partial^2 f(\mathbf{x})}{\partial x_1^2} & \cdots & \dfrac{\partial^2 f(\mathbf{x})}{\partial x_1 \partial x_n} \\ \vdots & \ddots & \vdots \\ \dfrac{\partial^2 f(\mathbf{x})}{\partial x_n \partial x_1} & \cdots & \dfrac{\partial^2 f(\mathbf{x})}{\partial x_n^2} \end{bmatrix}.$$

Since cross-partials are equal for a C^2 function, H(x) is a symmetric matrix.

12. Define Lagrangian form non linear programming problem.

$$L(x_1,\ldots,x_n,\lambda_1,\ldots,\lambda_k,\mu_1,\ldots,\mu_m) =$$

$$f(x_1,\ldots,x_n) - \sum_{i=1}^{k}\lambda_i\left(g_i(x_1,\ldots,x_n) - b_i\right)$$

13. Write the necessary conditions for Khun-Tucker method?

For Maximization problem

$$-\sum_{i=1}^{m}\mu_i\left(h_i(x_1,\ldots,x_n) - c_i\right).$$

$Maximize\ Z = f(X)$

$subject\ to\ \ g(X) \leq b,\ \ \rightarrow h(X) = g(X) - b \leq 0$

$X \geq 0, X = x_1, x_2, x_3,\ldots\ldots x_n.$

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$$\frac{\partial f}{\partial x_j} - \lambda \frac{\partial h}{\partial x_j} = 0$$

$$\lambda h(X) \le 0$$

$$\lambda \ge 0$$

14. Write the sufficient conditions for Khun-Tucker method?

Maximize (or) min *imize* $Z = f(X)$

subject to $g_i(X) \le 0, \ i = 1, 2, 3....r$

$$gi(X) \ge 0, \ i = r+1,......p$$

$$gi(X) \ne 0, \ i = p+1,......m$$

$$L(X, S, \lambda) = f(X) - \sum_{i=1}^{r} \lambda_i \left[g_i(X) + S_i^2 \right] - \sum_{i=r+1}^{p} \lambda_i \left[g_i(X) - S_i^2 \right] - \sum_{i=p+1}^{m} \lambda_i g_i(X)$$

UNIT-V OBJECT SCHEDULING
PART-A

1. What do you mean by a project?
   A project is defined as a combination of inter-related activities all of which must be executed in a certain order for completion.

2. What are the two basic planning and control techniques in a network analysis?
   ➢ Program Evaluation Review Technique (PERT)
   ➢ Critical Path Method(CPM)

3. What are the 3 main phases of a project?
   Planning, Scheduling and Control.

4. What is a network?
   It is the graphic representation of locality and sequentially connected arrows and nodes representing activities and events of a project.

5. What are the 3 common errors in the construction of network?
   ➢ Formation of loops
   ➢ Dangling
   ➢ Redundancy

6. What is dangling in a network?
    To disconnect an activity before the completion of all activities in a network diagram is known as dangling.

7. What are the 3 types of floats?
   ➢ Total float
   ➢ Free float
   ➢ Independent float

8. Define total float?

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The amount of time by which the completion of an activity could be delayed beyond the earliest expected completion time without affecting the overall project duration time is called the total float.

9. Define critical activity.
An activity is said to be critical if a delay in its start will cause a further delay in the completion of the enter project.

10. What is the critical path?
The sequence of critical activities in a network is called the critical path.

11. Distinguish between PERT and CPM.

PERT	CPM
➢ Event oriented ➢ Probabilistic ➢ Three time estimates namely optimistic, pessimistic, most likely are given ➢ Resources such as labour equipments, materials are limited	➢ Activity oriented ➢ Deterministic ➢ Time is fixed ➢ No limitations of resources

12. Define the expected variance of a project length?
The expected variance of a project length also called the variance of the critical path is the sum of the variance of all the critical activities.

13. Write down at least two main assumptions in PERT network calculation?
➢ The activity durations are independent
➢ The activity durations follow β-distribution

14. Define crashing?
The process of reducing the activity duration by putting an extra effort is called crashing the activity.

15. Define the cost time slope of an activity?
The cost slope indicating the increase in cost per unit and reduction in time, is defined as

$$\cos t \ slope = \frac{crash \ \cos t - normal \ \cos t}{normal \ time - crash \ time}.$$

16. Define crash time and crash cost.
The crash time represents the minimum duration time, that is possible and any attempts to further crash would only raise the activity cost without reducing the time. The activity cost corresponding to the crash time is called the crash cost.

17. What is resource scheduling?
Resource scheduling implies the task of allocation of resources to various activities in such a manner that the allocation is considered as acceptable under the given situation.

18. What is Resource leveling?

Resource leveling refers to the scheduling of the activities within the limits of the available floats in such a way that the variants in resource requirements are minimized.

19. What is resource smoothing?

Resource smoothing involves rescheduling of the activities of a project in such a way as to utilize the resource in a fairly uniform manner and achieving the minimum project duration.

20. Define optimum duration of a project?

Optimum duration of project is the duration for which the total cost associated with it is minimum.

21. Define the least duration of a project.

Least duration of a project is the minimum duration beyond which no more crashing of the activity as possible. The total cost associated with it is not necessarily minimum.

PART – B
UNIT-I LINEAR PROGRAMMING

1. A manufacturer produces two types of models M_1 and M_2 .Each model of the type M_1 requires 4 hours of grinding and 2 hours of polishing. Where as each model of the type M_2 requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 hours grinders and 3 publishers. Each grinder's works 40 hours week and each polisher works for 60 hours a week. Profit on M_1 model is Rs.3.00 and on model M_2 is 4.00. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models, so that the may make the maximum profit in a week?

2. A company manufacturer two products A and B. These products are processed in the same machine. It takes 10 minutes to process one unit of product A and 2 minutes for each unit of product B and the machine operates for a maximum of 35 hours in a week. Product A requires 1 kg and B requires 0.5 kg of raw material per unit, the supply of which is 600 Kg per week. Market constraint on product B is known to be minimum of 800 units every week. Product A costs Rs.5 per unit and sold at Rs.10. Products B costs Rs.6 per unit and can be sold in the market at a unit price of Rs. 8. Determine the number of units of A and B per week to maximize the profit.

3. A firm manufacturer 3 products A,B and C. The profits are Rs.3, Rs.2 and Rs.4 respectively. The firm has 2 machines and given below is the required processing time in minutes for each machine on each product.

Machines	Product-wise processing time		
	A	B	C
M_1	4	3	5
M_2	3	2	4

Machines M_1 and M_2 have 2000 and 2500 machine minutes respectively. The firm must manufacturer 100 units of A's 200 units of B's and 50 units C's but not more than 150 units of A's. Set up an LPP to maximize the profit.

4. A farmer has a 100 acre farm. He can sell all tomatoes, lettuce or radishes and can get a price of Rs. 1.00 per kg for tomatoes, Rs.0.75 a heap of Lettuce and Rs. 2.00 per kg for radishes. The average yield per acre is 2000 kg of tomatoes, 3000 heaps of lettuce and 1000 kg of radishes. Fertilizers are available at Ra. 0.50 and the amount required per acre 100 kg each for, tomatoes and lettuce and 50 kg for radishes. Labor required souring, cultivating and

harvesting per acre is 5 man-days for tomatoes and radishes and 6 man-days for lettuce. A total of 400 man-day. Formulate the maximize the farmers total profit

5. A company desires to devote the excess capacity of the 3 machines, lathe, shaping and milling machine of make 3 products A,B and C. The available time per month for these machines is tabulated below.

Machine	lathe	shaping	milling
Available time/month	200 hrs	100hrs	180 hrs

The time taken to produce each unit of the products A,B and C on the machines is displayed in the table below

machine	Time taken(hours)		
	Lathe	Shaping	milling
Product A	6	2	4
Product B	2	2	-
Product C	3	-	3

The profit per product would be Rs. 20, Rs.16 and Rs. 12 respectively on products A, B and C. Formulate a LPP to find the optimum product mix.

6. Solve the following LPP by graphical method

$$\min imize\, Z = 20x_1 + 10x_2$$

$$subject\ to\ \ x_1 + 2x_2 \le 40$$

$$3x_1 + x_2 \ge 30$$

$$4x_1 + 3x_2 \ge 60$$

$$x_1,\ x_2 \ge 0$$

7. Solve the following LPP by the graphical method

$$\max imize\, Z = 3x_1 + 2x_2$$

$$subject\ to\ \ -2x_1 + x_2 \le 1$$

$$x_1 \le 2$$

$$x_1 + x_2 \le 3$$

$$x_1,\ x_2 \ge 0$$

8. A company manufacturer 2 types of printed circuits. The requirements of transistors, resistors and capacitors for each type of printed circuits along with other data are given below.

	circuit		Stock available
	A	B	
Transistor	15	10	180
Resistor	10	20	200
Capacitor	15	20	210
Profit	Rs.5	Rs.8	

How many circuits of each type should the company produce from the stock to earn maximum profit.

9. Apply graphical method to solve the LPP

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$$\max imize \, Z = x_1 - 2x_2$$
$$subject \, to \, -x_1 + x_2 \leq 1$$
$$6x_1 + 4x_2 \geq 24$$
$$0 \leq x_1 \leq 5$$
$$and \, 2 \leq x_2 \leq 4$$

10. Use simplex method to solve the LPP
$$\max imize \, Z = 4x_1 + 10x_2$$
$$subject \, to \, 2x_1 + x_2 \leq 50$$
$$2x_1 + 5x_2 \leq 100$$
$$2x_1 + 3x_2 \leq 90$$
$$and \, x_1, x_2 \geq 0$$

11. Solve the following
$$\max imize \, 15x_1 + 6x_2 + 9x_3 + 2x_4$$
$$subject \, to \, 2x_1 + x_2 + 5x_3 + 6x_4 \leq 20$$
$$3x_1 + x_2 + 3x_3 + 25x_4 \leq 24$$
$$7x_1 + x_4 \leq 70$$
$$and \, x_1, x_2, x_3, x_4 \geq 0$$

12. Use simplex method to
$$\min imize \, Z = x_2 - 3x_3 + 2x_5$$
$$subject \, to \, 3x_2 - x_3 + 2x_5 \leq 7$$
$$-2x_1 + 4x_3 \leq 12$$
$$-4x_2 + 3x_3 + 8x_5 \leq 10$$
$$x_2, \, x_3, x_5 \geq 0$$

13. Solve the following LPP by simplex method
$$\max imize \, Z = 3x_1 + 2x_2$$
$$subject \, to \, 2x_1 + x_2 \leq 2$$
$$3x_1 + 4x_2 \geq 2$$
$$and \, x_1, x_2 \geq 0$$

14. Use penalty method to
$$\max imize \, Z = 2x_1 + x_2 + x_3$$
$$subject \, to \, 4x_1 + 6x_2 + 3x_3 \leq 8$$
$$3x_1 - 6x_2 - 4x_3 \leq 1$$
$$2x_1 + 3x_2 - 5x_3 \geq 4$$
$$and \, x_1, x_2, x_3 \geq 0$$

15. Using simplex method
$$\min imize \, Z = -2x_1 - x_2$$
$$subject \, to \, x_1 + x_2 \geq 2$$
$$x_1 + x_2 \leq 4$$
$$x_1, \, x_2 \geq 0$$

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UNIT-II
DUALITY AND NETWORKS

1. Write down the dual of the following LPP and it

$$\max imize \, Z = 4x_1 + 2x_2$$

$$subject \, to \, -x_1 - x_2 \le -3$$

$$-x_1 + x_2 \ge -2$$

$$x_1, x_2 \ge 0$$

2. Apply the principle of duality to solve the LPP

$$\max imize \, Z = 3x_1 + 2x_2$$

$$subject \, to \quad x_1 + x_2 \ge 1$$

$$x_1 + x_2 \le 7$$

$$x_1 + 2x_2 \le 10$$

$$and \, x_1, x_2 \ge 0, \, x_2 \le 3$$

3. Using dual simplex method solve the LPP

$$\min imize \, Z = x_1 + x_2$$

$$subject \, to \quad 2x_1 + x_2 \ge 2$$

$$-x_1 - x_2 \ge 1$$

$$and \, x_1, x_2 \ge 0,$$

4. Use dual simplex method to solve the LPP

$$\max imize \, Z = 2x_1 - x_3$$

$$subject \, to \quad x_1 + x_2 - x_3 \ge 5$$

$$x_1 - 2x_2 + 4x_3 \ge 8$$

$$and \, x_1, x_2, x_3 \ge 0$$

5. Find the initial solution to the following transportation problem using VAM

destination factory	D1	D2	D3	D4	Supply
F1	3	3	4	1	100
F2	4	2	4	2	125
F3	1	5	3	2	75
Demand	120	80	75	25	300

6. Solve the following transportation problem

destination source	P	Q	R	S	Supply
A	21	16	25	13	11
B	17	18	14	23	13
C	32	17	18	41	19
Demand	6	10	12	15	43

7. Solve the following transportation problem starting with the initial solution obtained by VAM.

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	D1	D2	D3	D4	Supply
O1	2	2	2	1	3
O2	10	8	5	4	7
O3	7	6	6	8	5
Demand	4	3	4	4	15

8. Solve the transportation problem when the unit transportation costs, demands and suppliers are as given below.

Destination origin	D1	D2	D3	D4	Supply
O1	6	1	9	3	70
O2	11	5	2	8	55
O3	10	12	4	7	70
Demand	85	35	50	45	

9. Using the following cost matrix determine a) optimal job assignment b). The cost of assignments

JOB

		1	2	3	4	5
	A	10	3	3	2	8
	B	9	7	8	2	7
mechanics	C	7	5	6	2	4
	D	3	5	8	2	4
	E	9	10	9	6	10

10. A company has 5 jobs to be done on five machines. Any jobs can be done on any machine. The costs of doing the jobs on different machines are given below. Assign the jobs for different machines so as to minimize the total cost

MACHINES

		1	2	3	4	5
	A	13	8	16	18	19
	B	9	15	24	9	12
JOBS	C	12	9	4	4	4
	D	6	12	10	8	13
	E	15	10	18	12	20

11. Solve the following assignment problem in order to minimize the total cost. The cost matrix given below gives the assignment cost when different operators are assigned to various machines

OPERATORS

		I	II	III	IV	V
	A	30	25	33	35	36
	B	23	29	38	23	26
MACHINES	C	30	27	22	22	22
	D	25	31	29	27	32
	E	27	29	30	24	32

12. A company has 4 machines to do 3 jobs. Each job can be assigned to only one machine. The cost of each job on each machine is given below. Determine the job assignment that will minimize the total cost.

MACHINES

	W	X	Y	Z
A	18	24	28	32

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JOB	B	8	13	17	18
	C	10	15	19	22

13. A travelling salesman has to visit 5 cities. He wishes to start from a particular city visit each city once and then returns to his starting point. Cost of going from one city to another is shown below. You are required to find the least cost route

TO CITY

FROM CITY		A	B	C	D	E
	I	∞	4	10	14	2
	II	12	∞	6	10	4
	III	16	14	∞	8	14
	IV	24	8	12	∞	10
	V	2	6	4	16	∞

14. A machine operator processes five types of items on his machine each week and must choose a sequence for them. The setup cost per change depends on the items presently on the machine and the setup to be made according to the following table

TO ITEM

FROM ITEM		A	B	C	D	E
	A	∞	4	7	3	4
	B	4	∞	6	3	4
	C	7	6	∞	7	5
	D	3	3	7	∞	7
	E	4	4	5	7	∞

15. A salesman has to visit five cities A, B, C, D and E. The distance (in hundred miles) between the five cities is a follows:

TO

FROM		A	B	C	D	E
	A	-	7	6	8	4
	B	7	-	8	5	6
	C	6	8	-	9	7
	D	8	5	9	-	8
	E	4	6	7	8	-

UNIT-III
INTEGER PROGRAMMING

1. Find the optimum integer solution to the following LPP

$Max\ Z = x_1 + x_2$

$subject\ to\ \ 3x_1 + 2x_2 \leq 5$

$x_2 \leq 2,$

$x_1, x_2 \geq 0\ and\ are\ \text{int}egers$

2. Find an optimum integer solution to the following LPP

$Max\ Z = x_1 + 2x_2$

$subject\ to\ \ \ 2x_2 \leq 7,$

$x_1 + x_2 \leq 7$

$2x_1 \leq 11,$

$x_1, x_2 \geq 0\ and\ are\ \text{int}egers$

3. Solve the integer programming problem

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$Max\ Z = 7x_1 + 9x_2$

$subject\ to\quad -x_1 + 3x_2 \le 6$

$\qquad\qquad 7x_1 + x_2 \le 35,$

$\qquad x_1, x_2 \ge 0\ \ and\ \ are\ \text{int}\,egers$

4. Solve the integer programming problem

$Max\,mize\quad Z = 5x_1 + 7x_2$

$subject\ to\quad -2x_1 + 3x_2 \le 6$

$\qquad\qquad 6x_1 + x_2 \le 30,$

$\qquad x_1, x_2 \ge 0\ \ and\ \ are\ \text{int}\,egers$

5. Consider the problem

$Max\,mize\quad Z = 2x_1 + 20x_2 - 10x_3$

$subject\ to\quad 2x_1 + 20x_2 + 4x_3 \le 15$

$\qquad\qquad 6x_1 + 20x_2 + 4x_3 = 20,$

$\qquad x_1, x_2, x_3 \ge 0\ \ and\ \ are\ \text{int}\,egers$

   Solve the problem as a continuous linear program; then show that it is impossible to obtain feasible integer solution by using simple rounding. Solve the problem using any integer problem algorithm.

6. Solve

$Max\,mize\quad Z = 4x_1 + 6x_2 + 2x_3$

$subject\ to\quad 4x_1 - 4x_2 \le 5$

$\qquad\qquad -x_1 + 6x_2 \le 5,$

$\qquad\qquad -x_1 + x_2 + x_3 \le 5$

$\qquad x_1, x_2, x_3 \ge 0\ \ and\ \ \ x_1, x_3\ are\ \text{int}\,egers$

7. Solve the following mixed integer problem by the branch and bound technique:

$Max\,mize\quad Z = x_1 + x_2$

$subject\ to\quad 2x_1 + 5x_2 \le 16$

$\qquad\qquad 6x_1 + 5x_2 \le 30,$

$\qquad x_1 \ge 0\ \ and\ \ \ \text{int}\,eger$

8. Solve the following mixed integer problem by the branch and bound technique:

$Max\,mize\quad Z = 2x_1 + 3x_2$

$subject\ to\quad 6x_1 + 5x_2 \le 25$

$\qquad\qquad x_1 + 3x_2 \le 10,$

$\qquad x_1, x_2\ non\ negative\ \text{int}\,egers$

9. Use branch and bound algorithm to solve

$Max\,mize\quad Z = 5x_1 + 4x_2 + 4x_3 + 2x_4$

$subject\ to\quad x_1 + 3x_2 + 2x_3 + x_4 \le 10$

$\qquad\qquad 5x_1 + x_2 + 3x_3 + 2x_4 \le 15,$

$\qquad\qquad x_1 + x_2 + x_3 + x_4 \le 6,$

$\qquad\qquad x_1, x_2, x_3, 2x_4 \ge 0$

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10. Solve by branch and bound method

$$Max\,mize \quad Z = 2x_1 + 3x_2$$

$$subject\ to \quad 5x_1 + 7x_2 \le 35$$

$$4x_1 + 9x_2 \le 36,$$

$$x_1, x_2 \ non\ negative \ \text{int}\,egers$$

11. A firm has divided its marketing area into three zones. The amount of sales depends upon the number of salesmen in each zone. The firm has been collecting the data regarding sales and salesmen in each area over a number of past years. The information is summarized in below table. For the next year firm has only 9 salesmen and the problem is to allocate these salesmen to three different zones so that the total sales are maximum.

No. of salesmen	Zone 1	Zone 2	Zone 3
0	30	35	42
1	45	45	54
2	60	52	60
3	70	64	70
4	79	72	82
5	90	82	95
6	98	93	102
7	105	98	110
8	100	100	110
9	90	100	110

12. The owner of a chain of four grocery stores has purchased six crates of fresh strawberries. The following table gives the estimated profits at each store when it is allocated various number of boxes

		STORES			
		1	2	3	4
	0	0	0	0	0
NUMBER	1	4	2	6	2
OF	2	6	4	8	3
BOXES	3	7	6	8	4
	4	7	8	8	4
	5	7	9	8	4
	6	7	10	8	4

The owner does not wish to split crates between stores, but is willing to make per allocations. Find the allocation of six crates so as to maximize the profits.

13. Use dynamic programming to solve the following LPP.

$$Max\,mize \quad Z = 3x_1 + 5x_2$$

$$subject\ to \quad x_1 \le 4$$

$$x_2 \le 6,$$

$$3x_1 + 2x_2 \le 18$$

$$x_1, x_2 \ non\ negative \ \text{int}\,egers$$

14. Solve the following LPP by the method of dynamic programming:

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$$Max\,mize \quad Z = 2x_1 + 5x_2$$
$$subject\,to \quad 2x_1 + x_2 \le 430$$
$$2x_2 \le 460,$$
$$x_1, x_2 \ge 0$$

15. Solve the following LPP by dynamic programming:

$$Max\,mize \quad Z = 50x_1 + 100x_2$$
$$subject\,to \quad 10x_1 + 5x_2 \le 2500$$
$$4x_1 + 10x_2 \le 2000$$
$$x_1 + \frac{3}{2}x_2 \le 450$$
$$x_1, x_2 \ge 0$$

UNIT-IV
CLASSICAL OPTIMIZATION THEORY

1. Solve the following NLPP.

$$Maximize \ Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$
$$subject\ to\ x_1 + 2x_2 = 2$$
$$x_1, x_2 \ge 0$$

2. Obtain the necessary and sufficient conditions for the optimal solution of the following problem. What is the optimal solution?

$$Minimize \ Z = 2e^{3x_1+1} + e^{2x_2+3}$$
$$subject\ to\ x_1 + x_2 = 5$$
$$x_1, x_2 \ge 0$$

3. Use the method of Lagrangean multipliers to solve the following NLPP. Does the solution maximize or minimize the objective function?

$$Optimize \ Z = 2x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$$
$$subject\ to\ x_1 + x_2 + x_3 = 20$$
$$x_1, x_2, x_3 \ge 0$$

4. Solve the non-linear programming problem given below:

$$Optimize \ Z = x_1^2 + x_2^2 + x_3^2$$
$$subject\ to\ x_1 + x_2 + 3x_3 = 2$$
$$5x_1 + 2x_2 + x_3 = 5$$
$$x_1, x_2, x_3 \ge 0$$

5. Solve the following NLPP using Khun-Tucker conditions

$$Maximize \ Z = 2x_1^2 - 7x_2^2 + 12x_1x_2$$
$$subject\ to\ 2x_1 + 5x_2 \le 98$$
$$x_1, x_2 \ge 0$$

6. Solve the following NLPP:

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Maximize $Z = 7x_1^2 + 5x_2^2 + 6x_1$

subject to $x_1 + 2x_2 \leq 10$

$\qquad x_1 - 3x_2 \leq 9$

$\qquad x_1, x_2 \geq 0$

7. Use the Khun-Tucker conditions to solve the following non-linear programming problem:

Maximize $Z = 2x_1 - x_1^2 + x_2$

subject to $2x_1 + 3x_2 \leq 6$

$\qquad 2x_1 + x_2 \leq 4$

$\qquad x_1, x_2 \geq 0$

8. Use the Khun-Tucker conditions to solve the following non-linear programming problem:

Maximize $Z = 7x_1^2 + 5x_2^2 - 6x_1$

subject to $x_1 + 2x_2 \leq 10$

$\qquad x_1 - 3x_2 \leq 9$

$\qquad x_1, x_2 \geq 0$

9. Consider the linear program

Maximize $Z = 2x_1 + 3x_2$

Subject to $x_1 + x_2 + x_3 = 5$

$\qquad x_1 - x_2 + x_4 = 3$

$\qquad x_1, x_2, x_3, x_4 \geq 0$

10. Find the real positive root of $3x - \cos x - 1 = 0$ by Newton's method correct to 6 decimal places.

11. Find a root of $x \log_{10} x - 1.2 = 0$ by N.R method correct to three decimal places

12. Using N.R method, solve $x \log_{10} x = 12.34$ start with $x_0 = 10$.

13. Write down Newton-Raphson formula for finding $\sqrt{a}$ where a is a positive number and hence find

$\sqrt{5}$.

14. Find the iterative formula for finding the value of $\dfrac{1}{N}$ where N is a real number, using

Newton-Raphson method. Hence evaluate 1/26 correct to 4 decimal places.

UNIT-V
OBJECT SCHEDULING

1. Construct a network for each of the projects whose activities and their precedence relationship are given below.

Activity	A	B	C	D	E	F	G	H	I	J	K
predecessor	-	-	-	A	B	B	C	D	E	H,I	F,G

2. A, B and C can start simultaneously A < D, I; B < G, F; D < G,F ; C < E; E < H, K; F < H,K;
 G, H < J.

3. A project scheduling has the following characteristics.

activity	1-2	1-3	2-4	3-4	3-5	4-9	5-6	5-7	6-8	7-8	8-10	9-10
Time(days)	4	1	1	1	6	5	4	8	1	2	5	7

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From the above information you are required to

i). construct a network diagram

ii). Complete the earliest event time and latest event time.

iii). Determine the critical path and total project duration

iv). Compute total and free float for each activity.

4. A small maintenance project consists of the following jobs whose precedence relationships are given below:

Job	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Duration days	15	15	3	5	8	12	1	14	3	14

i).Draw an arrow diagram representing the project .

ii). Find the total float for each activity.

iii). Find the critical path and the total project duration.

5. The following table shows the jobs of a project with their duration in days. Draw the network and determine the critical path. Also calculate all the floats.

Jobs	1-2	1-3	1-4	2-5	3-7	4-6	5-7	5-8	6-7	6-9	7-10	8-10	9-10	10-11	11-12
Duration	10	8	9	8	16	7	7	7	8	5	12	10	15	8	5

6. A project consists of a series of tasks labeled A, B, C,….H, I with the following constraints A < D,E ; B, D < F; C < G; B < H; F, G < I; W < X,Y means X and Y cannot start until W is completed. You are required to construct a network using this notation. Also find the minimum time of completion of the project when the time of completion of each task is given as follows:

Task	A	B	C	D	E	F	G	H	I
Time (days)	23	8	20	16	24	18	19	4	10

7. The following table shows the jobs of a network along with their time estimation.

Job	1-2	1-6	2-3	2-4	3-5	4-5	6-7	5-8	7-8
a(days)	1	2	2	2	7	5	5	3	8
m(days)	7	5	14	5	10	5	8	3	17
b(days)	13	14	26	8	19	17	29	9	32

Draw the project network and find the probability of the project completing in 40 days.

8. Construct the network for the project whose activities and the 3 time estimates of these activities (in weeks) are given below. Compute

i). Expected duration of each activity

ii). Expected variance of each activity.

iii). Expected variance of the project length

Activity	1-2	2-3	2-4	3-5	4-5	4-6	5-7	6-7	7-8	7-9	8-10	9-10
t_o	3	4	2	3	1	3	4	6	2	1	4	3
t_m	4	2	3	4	3	5	5	7	4	2	6	5
t_p	5	3	4	5	5	7	6	8	6	3	8	7

9. A small projects is composed of seven activities whose time estimates are listed in the table as follows:

Activity	1-2	1-3	2-4	2-5	3-5	4-6	5-6
a	1	1	2	1	2	2	3
m	1	4	2	1	5	5	6

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b	7	7	8	1	14	8	15

i). Draw the project network.
ii). Find the expected duration and variance of each activity
iii). Calculate the earliest and latest occurrence for each event and the expected project length
iv). Calculate the variance and standard deviation of project length.
v). what is the probability that the project will be completed ?
　　a). 4 weeks earlier than expected
　　b). Not more than 4 weeks later than expected ?
　　c). If the project due date is 19 weeks, what is the probability of meeting the due date?.
10. The following table shows the jobs of network along with their time estimates. The time estimates are in days.

Jobs	1-2	1-6	2-3	2-4	3-5	4-5	5-8	6-7	7-8
a	3	2	6	2	5	3	1	3	4
m	6	5	12	5	11	6	4	9	19
b	15	14	30	8	17	15	7	27	28

a). Draw the project network.
b). Find the critical path.
c). Find the probability of the project being completed in 31 days.
11. Assuming that the expected times are normally distributed find the probability of meeting the scheduled time as given for the network.

Activity	1-2	1-3	2-4	3-4	4-5	3-5
a	2	9	5	2	6	8
m	5	12	14	5	6	17
b	14	15	17	12	12	20

Scheduled project completion time 30 days. Also find the date on which the project manager can complete the project with a probability of 0.90.
12. Determine the optimum project duration and cost for the following data:

Activity	Normal		Crash	
	Time(days)	Cost	Time(days)	cost
1-2	8	100	6	200
1-3	4	150	2	350
2-4	2	50	1	90
2-5	10	100	5	400
3-4	5	100	1	200
4-5	3	80	1	100

Indirect cost is Rs. 70 per day.
13. The following table gives the activities of a construction of project along with other relevant information.
 i). what is the normal project length and the minimum project length?
ii). Determine the minimum crashing cost of schedule ranging from normal length down to and including the minimum length schedule

Activity	Normal duration	Crash duration	Cost of crashes
1-2	9	6	20
1-3	8	5	25
1-4	15	10	30

2-4	5	3	10
3-4	10	6	15
4-5	2	1	40

iii). What is the optimal length schedule duration of each job for your solution? Overhead of the project is Rs. 60 per day

14. The table below provides costs and estimates for a seven activity project.

Activity	Time estimate		Direct cost estimate	
	normal	crash	normal	crash
A 1-2	2	1	10	15
B 1-3	8	5	15	21
C 2-4	4	3	20	24
D 3-4	1	1	7	7
E 3-5	2	1	8	15
F 4-6	5	3	10	16
G 5-6	6	2	12	36

i). Draw the project network corresponding to normal time.
ii). Determine the critical path, normal duration and cost of the project.
iii). Crash the activities so that the project completion time reduces to 9 weeks?

15. The following time cost table (time in weeks and cost in rupees) applies to a project. Use it to arrive at the network associated with completing the project in minimum time with minimum cost.

Activity	Normal		Crash	
	Time	Cost	Time	Cost
1-2	2	800	1	1400
1-3	5	1000	2	2000
1-4	5	500	3	1800
2-4	1	500	1	500
2-5	5	1500	3	2100
3-4	4	2000	3	3000
3-5	6	1200	4	1600
4-5	5	900	3	1600

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Reg. No. :

Question Paper Code : 80307

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Seventh Semester

Computer Science and Engineering

CS 6704 — RESOURCE MANAGEMENT TECHNIQUES

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

(Uses of Normal Table is permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define feasible solution and optimal solution to the linear programming problem.

2. What do you mean by shadow pricing?

3. What are the characteristics of a promal and dual problem?

4. State the necessary and sufficient condition for a transportation problem to have a solution.

5. Mention some important applications of integer programming problem.

6. Write down the methods for solving integer linear programming problems.

7. Write down the Lagraugian function for Khun-Tucker method for following non linear programming with inequality constraints.

8. Examine $f(x) = 6x^5 - 4x^3 + 10$ for extreme points.

9. If there are five activities P, Q, R, S and T such that P, Q, R have no immediate predecessors but S and T have immediate predecessors P, Q and Q, R respectively. Represent this situation by a network.

10. Define critical path.

PART B — (5 × 16 = 80 marks)

11. (a) Solve the following linear programming problem using graphical method. (16)

Maximize $Z = 100X_1 + 80X_2$
Subject to $5X_1 + 10X_2 \leq 50$
$8X_1 + 2X_2 \geq 16$
$3X_1 - 2X_2 \geq 6$
X_1 and $X_2 \geq 0$.

Or

(b) Solve the following LPP by simplex method. (16)
Max $Z = 4x_1 + x_2 + 3x_3 + 5x_4$
Subject to $4x_1 - 6x_2 - 5x_3 + 4x_4 \geq -20$
$3x_1 - 2x_2 + 4x_3 + x_4 \leq 10$
$8x_1 - 3x_2 + 3x_3 + 2x_4 \leq 20$
$x_1, x_2, x_3, x_4 \geq 0$.

12. (a) Use dual simplex method to solve the LPP. (16)
Maximize $Z = -3x_1 - 2x_2$
Subject to $x_1 + x_2 \geq 1$
$x_1 + x_2 \leq 7$
$x_1 + 2x_2 \geq 10$
$x_2 \leq 3$
and $x_1, x_2 \geq 0$.

Or

(b) Consider the problem of assigning four sales persons to four different sales regions as shown in the following table such that the total sales is maximized.

		Sales region			
		1	2	3	4
	1	10	22	12	14
Salesman	2	16	18	22	10
	3	24	20	12	18
	4	16	14	24	20

The cell entries represent annual sales figures in lakhs of rupees. Find the optional allocation of the sales persons to different regions. (16)

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13. (a) Solve the following IPP. (16)

Minimize $Z = -2x_1 - 3x_2$

Subject to $2x_1 + 2x_2 \leq 7$

$$x_1 \leq 2$$
$$x_2 \leq 2$$

and $x_1, x_2 \geq 0$ and integers.

Or

(b) A student has to take examinations in three courses A, B and C. He has three days available for study. He feels it would be best to devote a whole day to the study of the same course, so that he may study a course for one day, two days or three days or not at all. His estimates of grades he may get by study are as follows :

Course/Study days	A	B	C
0	0	1	0
1	1	1	1
2	1	3	3
3	3	4	3

How should he plan to study so that he maximizes the sum of his grades?
(16)

14. (a) Using Jacobian method Max $Z = 2x_1 + 3x_2$ (16)

Subject to $x_1 + x_2 + x_3 = 5$

$$x_1 + x_2 + x_4 = 3$$
$$x_1, x_2, x_3, x_4 \geq 0.$$

Or

(b) Solve the nonlinear programming problem by Khun-Tucker conditions. (16)

Minimize $f(x) = x_1^2 + x_2^2 + x_3^2$

Subject to $g_1(X) = 2x_1 + x_2 - 5 \leq 0$

$$g_2(X) = x_1 + x_2 - 2 \leq 0$$
$$g_3(X) = 1 - x_1 \leq 0$$
$$g_4(X) = 2 - x_2 \leq 0$$
$$g_5(X) = -x_3 \leq 0.$$

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15. (a) A project consists of activities from A to J as shown in the following table. The immediate predecessor(s) and the duration in weeks of each of the activities are given in the same table. Draw the project network and, find the critical path and the corresponding project completion time. Also, find the total float as well as free float for each of the non-critical activities.

(16)

Activity	Immediate Predecessor (s)	Duration (weeks)
A	-	4
B	-	3
C	A, B	2
D	A, B	5
E	B	6
F	C	4
G	D	3
H	F, G	7
I	F, G	4
J	E, H	2

Or

(b) Consider the data of a project summarized in the following table :

Activity	Immediate Predecessor(s)	Duration (weeks)		
		a	m	b
A	-	4	4	10
B	-	1	2	9
C	-	2	5	14
D	A	1	4	7
E	A	1	2	3
F	A	1	5	9
G	B, C	1	2	9
H	C	4	4	4
I	D	2	2	8
J	E, G	6	7	8

(i) Construct the project network.

(ii) Find the expected duration and the variance of each activity.

(iii) Find the critical path and the expected project completion time.

(iv) What is the probability of completing the project on or before 35 weeks?

(16)

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IT6801   **SERVICE ORIENTED ARCHITECTURE**   **L T P C - 3 0 0 3**

UNIT I INTRODUCTION TO XML   **9**

XML document structure – Well formed and valid documents – Namespaces – DTD – XML Schema – X-Files.

UNIT II BUILDING XML- BASED APPLICATIONS   **9**

Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.

UNIT III SERVICE ORIENTED ARCHITECTURE   **9**

Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA -- Principles of Service orientation – Service layers.

UNIT IV WEB SERVICES   **9**

Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message

Exchange Patterns – Orchestration – Choreography –WS Transactions.

UNIT V BUILDING SOA-BASED APPLICATIONS   **9**

Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines -- Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE

TOTAL : 45 PERIODS

OUTCOMES:

Upon successful completion of this course, students will be able to:

☐ Build applications based on XML.

☐ Develop web services using technology elements.

☐ Build SOA-based applications for intra-enterprise and inter-enterprise applications.

TEXTBOOKS:

1. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2002.

2. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005.

REFERENCES:

1. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002

2. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education,

2005

3. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's

Guide", Prentice Hall, 2004.

4. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "Java Web Services Architecture", Morgan Kaufmann Publishers, 2003.

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UNIT I- INTRODUCTION TO XML

PART A

1. What is XML?

- XML stands for E**x**tensible **M**arkup **L**anguage
- XML is a **markup language** much like HTML.
- XML was designed to **describe data**.
- XML tags are not predefined in XML.You must **define your own tags**.
- XML is **self describing**.
- XML uses a DTD (**Document Type Definition**) to formally describe the data.

2. What are the advantages of XML?

- XML is text (Unicode) based.

  Takes up less space.

  Can be transmitted efficiently.

- One XML document can be displayed differently in different media.

  Html, video, CD, DVD,

  You only have to change the XML document in order to change all the rest.

- XML documents can be modularized. Parts can be reused.

3. Differentiate XML and HTML.

s.no	XML	HTML
1.	XML is used to mark up data so it can be processed by computers	HTML is used to mark up text so it can be displayed to users
2	XML describes only content, or "meaning"	HTML describes both structure (e.g. <p>, <h2>, <em>) and appearance (e.g. , <font>, <i>)
3	In XML, you make up your own tags	HTML uses a fixed, unchangeable set of tags
4	XML was designed to describe data and to focus on what data is.	HTML was designed to display data and to focus on how data looks.
5	XML is about describing information.	HTML is about displaying information

6	XML tags are different for different applications, and users know what they mean. XML tags are used to describe documents and data.	HTML tags have a fixed meaning and browsers know what it is. HTML tags are used for display.

4. What is XML used for?

- XML documents are used to transfer data from one place to another often over the Internet.
- XML subsets are designed for particular applications.
- One is RSS (Rich Site Summary or Really Simple Syndication).
- It is used to send breaking news bulletins from one web site to another.
- A number of fields have their own subsets. These include chemistry, mathematics, and books publishing.
- Most of these subsets are registered with the W3Consortium and are available for anyone's use.

5. List out the rules for XML document structures.

- Tags are enclosed in angle brackets.
- Tags come in pairs with start-tags and end-tags.
- Tags must be properly nested.

    <name><email>…</name></email> is not allowed.

    <name><email>…</email><name> is.

- Tags that do not have end-tags must be terminated by a '/'.

 is an html example.

- Tags are case sensitive.

    <address> is not the same as <Address>

- XML in any combination of cases is not allowed as part of a tag.
- Tags may not contain '<'or '&'.
- Tags follow Java naming conventions, except that a single colon and other characters are allowed. They must begin with a letter and may not contain white space.
- Documents must have a single *root* tag that begins the document.

6. What is schema?

- Schemas are themselves XML documents.

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- They were standardized after DTDs and provide more information about the document.
- They have a number of data types including string, decimal, integer, Boolean, date, and time.
- They divide elements into simple and complex types.
- They also determine the tree structure and how many children a node may have.

7. Differentiate well formed and valid documents .

Well-formed Documents

- A document can only be well-formed it obeys the syntax of XML. A document that includes sequences of markup characters that cannot be parsed or are invalid cannot be well-formed.

- In addition, the document must meet all of the following conditions (understanding some of these conditions may require experience with SGML):

- The document instance must conform to the grammar of XML documents. In particular, some markup constructs (parameter entity references, for example) are only allowed in specific places. The document is not well-formed if they occur elsewhere, even if the document is well-formed in all other ways.

- The replacement text for all parameter entities referenced inside a markup declaration consists of zero or more complete markup declarations. (No parameter entity used in the document may consist of only part of a markup declaration.)

- No attribute may appear more than once on the same start-tag.

- String attribute values cannot contain references to external entities.

- Non-empty tags must be properly nested.

- Parameter entities must be declared before they are used.

- All entities except the following: amp, lt, gt, apos, and quot must be declared.

- A binary entity cannot be referenced in the flow of content; it can only be used in an attribute declared as ENTITY or ENTITIES.

- Neither text nor parameter entities are allowed to be recursive, directly or indirectly.

- By definition, if a document is not well-formed, it is not XML. This means that there is no such thing as an XML document which is not well-formed, and XML processors are not required to do anything with such documents.

Valid Document

- A well-formed document is valid only if it contains a proper document type

- Declaration and if the document obeys the constraints of that declaration (element sequence and

- Nesting is valid, required attributes are provided, attribute values are of the correct type, etc.). The

- XML specification identifies all of the criteria in detail.

8. What is DTD?

- A Document Type Declaration enables an XML parser to verify whether an XML document is valid, i.e. its elements contain the proper attributes in the proper sequence.

- The document type declaration has the form:

  <! DOCTYPE address-book SYSTEM "address-book.dtd">

- It consists of markup (<! DOCTYPE), the name of the top-level element (address-book), the DTD (SYSTEM "address-book.dtd") and a right angle bracket. As Listing 3.1 illustrates, the document type declaration appears at the beginning of the XML document, after the XML declaration.

9. What are Benefits of the DTD?

- The main benefits of using a DTD are
    - The XML processor enforces the structure, as defined in the DTD.
    - The application accesses the document structure, such as to populate an element list.
    - The DTD gives hints to the XML processor—that is, it helps separate indenting from content.
    - The DTD can declare default or fixed values for attributes. This might result in a smaller document.

10. What is meant by a XML namespace? (APRIL/MAY 2011), (Nov/Dec 2012), (Nov/Dec 2013).

- An XML namespace is a collection of element and attribute names. Each namespace has a unique name that provides a means for document authors to unambiguously refer to elements with the same name in order to prevent collisions.

11. What is the use of XML declaration?

- XML declaration is a special tag used to specify the version of XML used to write the document and optionally some additional meta-information about the document such as the character set/encoding used. For e.g the syntax of XML declaration is

  <? XML VERSION="1.0"?>

12. What is RSS?

- RSS stands for RDF (Resource Description Framework) Site Summary and is also known as Rich Site Summary and Really Simple Syndication. RSS is popular and simple XML format designed to share headlines and web content between Web sites.

13. Define Function

- A function is a named block of code that performs a specific task, possibly acting upon a set of values given to it, or Parameters, and possibly returning a single value.

14. Define Template

- A template is an HTML-like document that defines the presentation of a web page, while a PHP script supplies the content. The separation of content and presentation is at the heart of any GUI paradigm.

15. What are built-in data types for XML Schema?

- The data types defined by the XML Schema specification itself are called its built-in data types.
- For e.g xsd: integer, xsd: decimal, xsd: string, xsd: Boolean, xsd: float etc.

16. What are the classifications XML Schema data types?

- There are two classes of XML Schema data types. They are

  (i)Simple (ii) Complex

17. What are simple and complex data types?

- A *simple type* is a data type whose values are represented in XML documents by character data and are used to represent individual values.
- A *complex type* is a data type whose values are represented using markup and are used to represent structured data.

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UNIT II BUILDING XML- BASED APPLICATIONS

1. What are the types of XML Parsers?

- There are two types
    - Validating Parsers
    - Non-Validating Parsers

2. What are XML Parsers?

- XML Parsers are used to check whether the document is well formed and valid.

3. How is XML parsing done with SAX? (NOV/DEC2011)

- A SAX parser is a mechanism for transforming an XML text document into stream of events corresponding to the markup and character data contained in the original document.

4. Explain Event-oriented parsing.

- In this parsing, Parser interacts with an application as its reads an XML document when certain events occur and this approach is used by SAX (Simple API for XML) based parsers.

5. What are the components of XSL?

- XSLT-XSL Transformations which defines the semantics of the various elements and attributes of the XSL namespace.
- XPATH – XML Path Language which defines the syntax and semantics of many of the attribute values used in XSL elements for accessing positions of the input XML document
- XSL-FO – XSL Formatting Objects is a separate vocabulary for defining style properties of an XML document.

6. What is the purpose of XSLT? (NOV/DEC2011) May/June 2012

- The XSLT stands for XSL Transformations and XSL stands for Extensible Style sheet Language.
- The purpose of XSLT is used for defining the XML document transformation and presentations.
- Thus using XSLT the xml document can be transformed into XHTML documents or some other XML document

7. What are XML Schemas?

- XML Schemas are part of the XML vocabulary and its addresses the standard for XML document validation by including a definition of a collection of standard data types which are used to describe data structures.

8. What is Xpath? Nov/Dec 2012.

- Xpath is used to navigate XML tree structures. Xpath gets its name from its use of a path notation to navigate through the hierarchical tree structure of an XML document. It is an important XML technology due to its role in providing a common syntax and semantics for functionality in both XSLT and XPointer.

9. What is XSL and why it is used. (APRIL/MAY 2008)

- The Extensible Style sheet Language (XSL) is an XML vocabulary typically used to transform XML document from one form to another form. XSL document are well-formed XML documents.

10. What is DOM?

- The Document Object Model (DOM) is the model that describes how all elements in an HTML page, like input fields, images, paragraphs etc., are related to the topmost structure: the document itself. By calling the element by its proper DOM name, we can influence it

11. What are the 2 traditional ways of assigning event handlers in DOM

1) Via HTML, using attributes 2) Via scripting 3. How to change an HTML Element with the help of DOM.

12. How to add Nodes in DOM Tree.

- Nodes can also be added to the DOM. You've already seen how attribute nodes can be created and applied to an element so let's look at adding element and text nodes within the document tree (without using the innerHTML property).

- The first step is to create a node object of the type you want using one of document.createElement(), document.createAttribute() or document.createTextNode(). For attributes, however, you'll probably just want to create an element node and assign it attributes directly

13. What are the types of nodes in DOM Tree?

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- Element nodes, as we've seen, correspond to individual tags or tag pairs in the HTML code. They can have child nodes, which may be other elements or text nodes. Text nodes represent content, or character data. They will have a parent node and possibly sibling nodes, but they cannot have child nodes. Attribute nodes are a special case. They are not considered a part of the document tree - they do not have a parent, children or siblings. Instead, they are used to allow access to an element node's attributes

14. What is Window Object in DOM?

- The window object represents an open window in a browser. If a document contain frames (or tags), the browser creates one window object for the HTML document, and one additional window object for each frame.

15. Explain the term XML schema. Nov/Dec 2013.

- The xml schemas are used to represent the structure of XML document. The goal or purpose of XML schema to define the building blocks of an XML document. These can be used as an alternative to XML DTD. XML defines the elements, attributes, elements having child elements, order of child elements.

16. Define XSD?

- SOA services communicate with messages formally defined via XML Schema (also called XSD). Communication among consumers and providers or services typically happens in heterogeneous environments, with little or no knowledge about the provider. Messages between services can be viewed as key business documents processed in an enterprise.

UNIT III SERVICE ORIENTED ARCHITECTURE

1. What is Service Oriented Architecture? May/June 2013

- Service oriented architecture is essentially a collection of services. These services communicate with each other. The communication can involve either simple data passing or it could involve two or more services coordinating some activity.

2. Define Contemporary SOA.

- Contemporary SOA represents an architecture that promotes service orientation through the use of web services.

3. List out some characteristics of Contemporary SOA. (NOV/DEC2011) May/June 2012

- Contemporary SOA is at the core of the service oriented platform.
- Contemporary SOA increases quality of service.
- Contemporary SOA is fundamentally autonomous.
- Contemporary SOA is based on open standards.
- Contemporary SOA supports vendor diversity.
- Contemporary SOA fosters intrinsic interoperability.
- Contemporary SOA promotes discovery.
- Contemporary SOA promotes federation.
- Contemporary SOA promotes architectural Composability.
- Contemporary SOA fosters inherent reusability.

4. What are the benefits of SOA? May/June 2013

- Improved integration and intrinsic interoperability.
- Inherent reuse.
- Streamlined architectures and solutions.
- Leveraging the legacy investment.
- Establishing standardized XML data representation.
- Focused investment on communications infrastructure.
- "Best-of-breed" alternatives.
- Organizational agility.

5. What are the common pitfalls of adopting SOA?

The common pitfalls of adopting SOA are:

- Building service oriented architectures like traditional distributed architectures
- Not standardizing SOA
- Not creating a transition plan
- Not starting with an XML foundation architecture
- Not understanding SOA performance requirements
- Not understanding web services security
- Not keeping in touch with product platforms and standards development

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6. What are the requirements is needed to fill QoS gaps between contemporary and Primitive SOA?

- Contemporary SOA is striving to fill the QoS gaps of the primitive SOA model with the following requirements:
    - Security (contents and access)
    - Reliability (message guaranteed delivery)
    - Appropriate performance
    - Protecting business integrity
    - Executing exception logic in case of failure

7. What is the design characteristics required to facilitate interoperability in contemporary SOA?

- The design characteristics required to facilitate interoperability are:
    - Standardization
    - Scalability
    - Behavioral predictability
    - Reliability

8. What is architecture?

- Architecture refers a systematic arrangement of computerized automation technological solutions.
- Application architecture is to an application development team what a blueprint is to a team of construction workers. Different organizations document different levels of application architecture.

9. What is application architecture?

- Application architecture is a template for all others which specifically explained the technology, boundaries, rules, limitations, and design characteristics that apply to all solutions based on this template.

10. **What is enterprise architecture?**

- Enterprise architecture is a creation of master specification when numerous, disparate and integrate application architectures exist within an organization.

11. What is Single-tier client-server architecture?

- Single-tier client-server architecture is an environment in which bulky mainframe back-ends server served the thin clients.

12. List out the primary characteristics of the two tier client server architecture?

- The primary characteristics of the two tier client server architectures is given below which is compared to SOA
    - Application logic
    - Application processing
    - Technology
    - Security
    - Administration

13. What is multi-tier client-server architectures?

- Multi-tier architecture (often referred to as n-tier architecture) is a client-server architecture in which the presentation, the application processing, and the data management are logically separate processes.

14. List out the types of communications of mainframe systems?

- The different types of communications of mainframe systems are:
    - Synchronous communication
    - Asynchronous communication

15. List out the types of service autonomy?

- The different types of service autonomy are:
    - Service-level autonomy
    - Pure autonomy

16. What are the key benefits of service reuse?

- The key benefits of service reuse are:
    - Accommodate future requirements with less development effort.
    - Reduce the need for creating wrapper services.
    - Reduction of cost by not just avoiding duplication of code.
    - Reducing risks by reusing well-tested code and runtime environments.

17. What are the issues that are raised in the client-server and the distributed Internet architecture?

- The issues that are raised in the client-server and the distributed Internet architecture comparisons are discussed in a comparison between multi-tier client-server and SOA.
    - Application logic
    - Application processing

- Technology

- Security

- Administration

18. What is the difference between services and components?

- Services are logical grouping of components to achieve business functionality.

Components are implementation approaches to make a service.

19. **Write down the layers of abstraction identified for SOA.**

- The three layers of abstraction identified for SOA are:
    - the application service layer
    - the business service layer
    - the orchestration service layer

20. **List some of the characteristics of Application Service layer.**

- Expose functionality within a specific processing context

- Draw upon available resources within a given platform

- Solution – agnostic

- Generic and reusable

- Achieve point-to-point integration with other application services

- Inconsistent in terms of the interface granularity they expose

- Mixture of custom-developed and third-party purchased services

21. Define Service-oriented architecture

- An SOA can refer to application architecture or the approach used to standardize technical architecture across the enterprise.

22. Define Client / Server architecture

- Mainframe back-ends served thin clients, are considered an implementation of the single-tier client-server architecture Mainframe systems natively supported both synchronous and asynchronous communication. The latter approach was used primarily to allow the server to continuously receive characters from the terminal in response to individual key-strokes. Only upon certain conditions would the server actually respond.

23. Define Distributed Internet architecture

- Distributing application logic among multiple components (some residing on the client, others on the server) reduced deployment headaches by centralizing a greater

amount of the logic on servers. Server-side components, now located on dedicated application servers, would then share and manage pools of database connections; alleviating the burden of concurrent usage on the database server A single connection could easily facilitate multiple users.

24. Define SOA Characteristics

- Services are discoverable and dynamically bound.¬ Services are self-contained and modular.¬ Services stress interoperability.¬ Services are loosely coupled.¬ Services have a network-addressable interface.¬ Services have coarse-grained interfaces.¬ Services are location-transparent.¬ Services are compos able.¬ Service-oriented architecture supports self-healing.¬

25. Define Coarse-Grained Services

- A service-based system controls the network access to the objects within the service through a set of coarse-grained interfaces. A service may still be implemented as a set of fine-grained objects, but the objects themselves are not accessible over a network connection. A service implemented as objects has one or more coarse-grained objects that act as distributed façades. These objects are accessible over the network and provide access to the internal object state from external consumers of the service. However, objects internal to the service communicate directly with each other within a single machine, not across a network connection.

26. Define Service Component.

- This is the true heart of the SOA. The Service Component is that logical unit of code which implements the functionality to support the Service. The Service Component exposes one or more Services. A Service Component is also usually associated with a data store of some kind. This can contain data about a fundamental data type, control data, process, data, etc depending on the nature of the particular service component.

27. Define Service-component-level Testing

- Service-component-level testing or Unit testing, is normally performed by the developers to test that the code not only successfully compiles, but the basic functionality of the components and functions within a service are working as specified. The primary goal of Component testing is to take the smallest piece of testable software in the application, isolate it from the remainder of the code, and

determine whether it behaves exactly as you expect. Each Component is tested separately before integrating it into a service or services.

28. Define Process/Orchestration-level Testing

- Process/Orchestration testing ensures services are operating collectively as specified. This phase of testing would cover business logic, sequencing, exception handling and process decomposition (including service and process reuse).

29. Define Security Testing

- As SOA evolves and grows within your organization, the profile and necessity of Security testing will increase. Today, many organizations perform an inadequate amount of penetration testing at the very end of a project. SOA combined with Government and Regulatory compliance, will require Security testing activities to be incorporated into the entire project life cycle.

30. Explain Legacy System Adapter

- It is my personal opinion that any time a Service Component needs to interface to a legacy system, that an Adapter Pattern should be used. This Adapter performs a number of tasks. Its primary function is to convert to/from data formats spoken by the legacy system and the common data formats used by the Foundational Service Components. In order to perform the conversions, it may be necessary for an adapter to interface with many Service Components in order to perform data enrichment or break data apart into its fundamental data types.

31. Define Composite Service Component

- A Composite Service Component is a component which combines the functionality of one or more other Foundational or Composite Service Components. It may also encapsulate additional functional and data enrichment, business process, etc. In some cases, a Composite Service Component may be purpose built to support one and only one business process or application, where it makes sense to encapsulate a piece of reusable functionality on the server side instead of in the application.

32. What are the Benefits of SOA?

- **LooseCoupling**

  Being on a SOA stack means that your infrastructure and architecture are split up into various services. This makes it pretty obvious to write software that tends to be loosely coupled (or less dependentoneachother).

- **Flexibility**

  SOA gives you the flexibility to write various components of your architecture in whatever language and platform you choose to. So this means, you could write the client facing side in a more dynamic and productive language like Python/Ruby/JavaScript and write the performance critical components in lower level languages like Java or C.

- **EasierTestingandDebugging**

  Having all your components isolated into various services makes it easy to test and debug all of them individually. Many organizations have separate teams to develop, test and maintain these components.

- **Scalability**

  this goes on a par with Flexibility. Having separate components makes it much simpler and stress-free to scale up your architecture. You could easily scale up a particular component and test it in isolation, without affecting other components at all. This makes it easy to add in serverswithoutfacinganydowntime.

- **Reusability**

  since various components are built out separately, it becomes much easier to reuse them later. For example, services like Netflix open sources various components of its architecture, for others to learn, use and modify it as per their requirements.

UNIT IV WEB SERVICES

1. What is Web Services? May/June 2013

- A web service is used to implement architecture according to service oriented architecture

  (SOA) concepts. The basic unit of communication is message.

- Web Services are software systems that are designed to be accessed using web protocols and technologies that are intended to be used by other software applications rather than directly by end users.

- Following are some example of web services.

- Whether forecast system.

- Currency converter.

- Electronic payment processing system.

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- Credit card validation system.

- Resource management system

2. What are the basic parts comprised in the web services framework?

The basic parts comprised in the web services framework are:

- one or more architectures

- technologies

- concepts

- models

- sub-frameworks

3. List out the characteristics of web services framework.

The various characteristics of web services framework are:

- An abstract (vendor-neutral) existence defined by standards organizations and implemented by (proprietary) technology platforms.

- Core building blocks that include web services, service descriptions, and messages.

- A communication agreement centered around service descriptions based on WSDL.

- A messaging framework comprised of SOAP technology and concepts.

- Service description registration and discovery architecture sometimes realized through UDDI.

- A well-defined architecture that supports messaging patterns and compositions.

- A second generation of web services extensions (also known as the WS-* specifications) continually broadening its underlying feature-set.

4. Write down the advantage of web services.

The various advantages of web services are:

- Flexible

- Adaptable

- Promotes interoperability

- Reduces complexity by encapsulation

- Enables just-in-time integration

5. Give the classification of web services design.

The different classification of web services design is:

- Temporary classification (service roles)

- Permanent classification (service models)

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6. Define Service.

A service is a unit of software capable of altering its role, depending on its processing

7. What are the fundamentals in role of service?

The different fundamental in role of services are:

- Service provider
- Service consumer
- Intermediaries
- Initial sender and ultimate receiver
- Service compositions

8. What is the service provider? May/June 2013

- The service provider is used to identify the organization (or individual) responsible for actually providing the web service. It simply referred as the service being invoked.

9. What is service requestor?

- Service requestor is a processing logic unit capable of issuing a request message that can be understood by the service provider.

10. What are referred to as intermediaries?

- Web services and service agents route and process a message after it is initially sent and before it arrives at its ultimate destination are referred to as intermediaries or intermediary services.

11. Give the types of intermediaries.

The different types of intermediaries are:

- Passive intermediary
- Active intermediary

12. What is meant by WSDL? (APRIL/MAY 2011), (Nov/Dec 2012)

- WSDL is Web Services Definition Language which is based on XML. WSDL defines the web service like operation, parameter, return values and communication protocols.
- SOA services have self-describing interfaces in platform-independent XML documents. Web Services Description Language (WSDL) is the standard used to describe the services

13. State the use of WSDL. (May/June 2012), (Nov/Dec 2013).

- Web Services Definition Language (WSDL) is used to describe the operations provided by a web service which includes defining the data to be passed from the client to the operation as well as the return value of the operation using SOAP.

14. Define UDDI? May/June 2014

- SOA services are maintained in the enterprise by a registry that acts as a directory listing. Applications can look up the services in the registry and invoke the service. Universal Description, Definition, and Integration (UDDI) is the standard used for service registry.

15. Specify How UDDI is utilized in Web Service. May/June 2014.

- The UDDI (Universal Description and Discovery, Integration) provides a directory of web services, so that client can easily discover the services of their choices. The UDDI maintains a registry in which the web services are registered.

16. Explain about QOS?

- Each SOA service has a quality of service (QoS) associated with it. Some of the key QoS elements are security requirements, such as authentication and authorization, reliable messaging, and policies regarding who can invoke services.

17. Define Service Proxy?

- The service provider supplies a service proxy to the service consumer. The service consumer executes the request by calling an API function on the proxy. It then formats the request message and executes the request on behalf of the consumer. The service proxy is a convenience entity for the service consumer. It is not required; the service consumer developer could write the necessary software for accessing the service directly.

18. List the Principles of service orientation Standardized Service.

- Contracts Service Loose Coupling Service Abstraction Service Reusability Service Autonomy Service Statelessness Service Discoverability Service Compos ability Service-Orientation and Interoperability

19. Define Service-Orientation and Interoperability.

- Service-oriented computing, stating that services must be interoperable is just about as evident as stating that services must exist. Each of the eight principles supports or contributes to interoperability in some manner.

20. Define service Loose coupling

- The principle of Service Loose Coupling promotes the independent design and evolution of a service's logic and implementation while still guaranteeing baseline interoperability with consumers that have come to rely on the service's capabilities.

21. What is the use of SOAP?

- The Simple Object Access Protocol (SOAP) is used to define a standard message format which is used for communication between services running on different operating systems.

22. List out some of the characteristics of SOAP messaging framework.

SOAP messaging framework ha the following three characteristics that are

- Extensible.
- Interoperable.
- Independent.

23. What are the parts of SOAP message?

SOAP message consists of the three parts:

  o SOAP envelope
  o SOAP header (optional)
  o SOAP body
  o SOAP fault

24. List out messaging styles offered by SOAP.

- RPC (Remote Procedure Call) style
- Document – style

25. Sketch the anatomy of a SOAP message.

```
<?xml version="1.0"?>
<soap:Envelope
    xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
    soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
        <soap:Header>
        ........
        </soap:Header>
        <soap:Body>
            ......
```

<soap:Fault>

......

</soap:Fault>

</soap:Body>

</soap:Envelope>

26. What is SOAP node?

- The programs that use services to transmit and receive SOAP messages are referred to as

SOAP nodes.

27. What is called the SOAP message path?

- The route taken by the message is called the SOAP message path. The set of SOAP nodes through which the SOAP message passes, including the initial sender, the ultimate receiver and one or more intermediaries are called the SOAP message path.

28. Define Message Exchange Pattern.

- Message Exchange Pattern (MEP) defines the way that SOAP messages are exchanged between the web service requester and web service provider. It represents a set of templates.

29. List out some primitive MEPs.

A common set of primitive MEPs are listed below

- Request-response
- Fire-and-forget
- Complex MEPs

30. List out the types of derived business services.

Business services are derived from the following sources

- Task-centric business services
- Entity-centric business services

31. List out the types of logic suitable for orchestration layer.

- Business rules
- Conditional logic
- Exception logic
- Sequence logic

32. What is the use of service candidates?

The service candidate is used to distinguish a conceptualized service from an actual implemented service.

33. What is the key service orientation principles applied to the service candidate?

- Reusability
- Autonomy
- Statelessness
- Discoverability

34. List out the elements in the WSDL document structure.

Element	Defines
<types>	The data types used by the web service
<message>	The messages used by the web service
<portType>	The operations performed by the web service
<binding>	The communication protocols used by the web service
<service>	The service location used by the web service

35. What is UDDI? (NOV/DEC 2011)

- Universal Description, Discovery and Integration (UDDI) is a directory service where businesses can register and search for Web services. UDDI is a platform-independent framework for describing services, discovering businesses, and integrating business services by using the Internet. UDDI stands for Universal Description, Discovery and Integration. It is a directory for storing information about web services. It is a directory of web service interfaces described by WSDL. It communicates via SOAP. It is built into the Microsoft .NET platform

36. What is port?

- Ports are purely abstractions in the computer's memory and do not represent anything physical like a serial port or parallel port.
- Each port is identified by a number from 1 to 65,535. Each port can be allocated to a particular service.
- Port numbers from 1 to 1023 are reserved for well-known services such as FTP, HTTP, e-mail, finger etc.

37. Give an example of a web service registry and its function. Nov/Dec 2012.

- The universal description and discovery integration (UDDI) provides a directory of web services so that client can easily discover the service of their choices. The UDDI maintains a registry in which the web services are registered.

38. Define the need for SOAP. May/June 2013.

The SOAP stands for simple object Access protocol. It is simple XML based protocol which allows applications to exchange information over HTTP. Typically web services make use of this protocol for exchange of information.

UNIT V BUILDING SOA-BASED APPLICATIONS

1. What is service composition?

- A service composition is a coordinated aggregate of services each is assigned with service composition number to complete a given task.
- Service compositions also are referred to as service assemblies.

2. What is Service oriented analysis? May/June 2013.

The service oriented analysis is the process of determining how business automation requirements can be represented through service orientation.

3. What are the goals needed for performing a service-oriented analysis?

The overall goals of performing a service-oriented analysis are as follows:

- Define a preliminary set of service operation candidates
- Group service operation candidates into logical contexts. These contexts represent service candidates.
- Define preliminary service boundaries so that they do not overlap with any existing or planned services.
- Identify encapsulated logic with reuse potential.
- Ensure that the context of encapsulated logic is appropriate for its intended use.
- Define any known preliminary composition models.

4. Give the step-by-step process in the service oriented analysis.

Step 1: Define business automation requirements

Step 2: Identify existing automation systems

Step 3: Model candidate services

5. What is Service modeling?

- Service modeling is a process of identifying candidate service operation and then grouping them into a logical context.

6. What is Business-centric SOA?

- A SOAD approach in designing SOA applications requires the following key elements:

- Process Model: Defining process and notation by orchestrating object-oriented analysis and design (OOAD), business process modeling (BPM) and enterprise architecture elements. Additional elements can also be defined if required.

- Instructions: Structured way to conceptualize services.

- Standards: Provide well-defined, quality factors and best practices of service, capability, data and constraint granularity. Roles must be well-defined as well, and lay out whether it is a developer, architect or analyst who is responsible for each fraction of the work.

- Artifacts: Define what is not a good service - such as services that are not reusable - and therefore do not qualify as SOA residents.

- Quality of Service: Facilitates end-to-end modeling and provides comprehensive tool support.

7. What is service oriented design?

- Service oriented design phase is a process that transforms previously modeled service Candidates into physical service designs.

8. Give the overall goals for performing a service oriented design.

The overall goals of performing a service oriented design are as follows:

- Determine the core set of architectural extensions.

- Set the boundaries of the architecture.

- Identify required design standards.

- Define abstract service interface designs.

- Identify potential service compositions.

- Assess support for service orientation principles.

- Explore support for characteristics of contemporary SOA.

9. Define Service Composition

- A *service composition* is an aggregate of services collectively composed to automate a particular task or business process. To qualify as a composition, at least two

participating services plus one composition initiator need to be present. Otherwise, the service interaction only represents a point-to-point exchange.
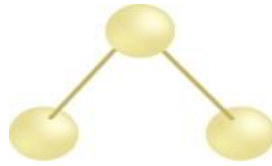
- Service compositions can be classified into primitive and complex variations. In early service-oriented solutions, simple logic was generally implemented via point-to-point exchanges or primitive compositions.

10. Define the following terms: May/June 2013.

- *WS-BPEL*

  o (*WS-BPEL*)-The **Web Services Business Process Execution Language** (*WS-BPEL*), commonly known as **BPEL** (*Business Process Execution Language*), is an OASIS[1] standard executable language for specifying actions within business processes with web services. Processes in BPEL export and import information by using web service interfaces exclusively.

- **WS-Coordination**

  o WS-Coordination is an extensible framework for the establishment of coordination between Web Services and coordinators. Different kinds of coordination types can be defined. Each coordination type can have multiple coordination protocols. Contexts used for transactions or security can be created and associated with messages. A context contains a reference to a registration service. WS-Transaction leverages the WS-Coordination specification.

- **WS-Policy**

  o WS-Policy can express requirements, capabilities and assertions. For example, a policy can indicate that a Web Service only accepts requests containing a valid signature or a certain message size should not be exceeded. How a policy can be obtained is out of the scope of this specification. WS-Metadata Exchange and WS-Policy Attachment specify how policies are accessible through SOAP messages or associated with XML and WSDL documents.

11. Define WS-Security or Web Services Security (WSS).

- Security is a requirement for adopting Web Services in critical applications. The integrity and confidentiality of messages must be guaranteed. Furthermore, the identity of the participating parties shout be proofed. The *Web Services Security Language*, or WS-Security for short, is a base for the implementation of a wide range of security solutions. In April 2004, the Organization for the Advancement of Structured Information Standards (OASIS) ratified WS-Security as a standard under the name OASIS Web Services Security (WSS).

- Signing and encryption of SOAP messages as well as the propagation of security tokens is supported by WS-Security. WS-Security leverages the XML Signature and XML Encryption standards by the W3C. Almost all WS-Specifications can be used in conjunction with WS-Security. For example, a

12. Define WS: Policy.

- Element inside a SOAP header should be signed to prevent tampering. WS-Secure Conversations and WS-Trust are layered on top of WS-Security.

13. How SOA support in J2EE. May/June 2015

- The Java 2 Platform Enterprise Edition (J2EE) is one of the two primary platforms currently being used to develop enterprise solutions using Web services. This section briefly introduces parts of the J2EE platform relevant to SOA. We then proceed to revisit the service-orientation principles and primary primitive and contemporary SOA characteristics established earlier in this book to discuss how these potentially can be realized using the previously explained parts of J2EE.

14. What are the various layers present in the J2ee Platform?

Relevant layers of the J2EE platform as they relate to SOA.
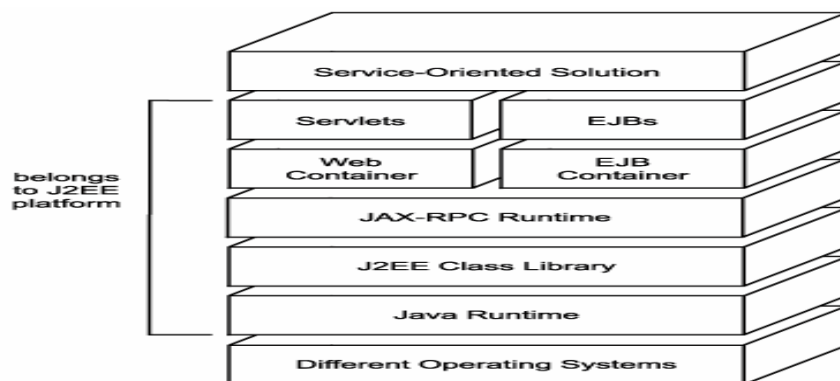
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PART B QUESTIONS
UNIT I

1. Explain in detail about XML document structure with example.

2. List and Explain the XML syntax rules in detail. (MAY 2011)

3. Compare well formed and valid documents.

4. Discuss in detail about Namespaces with examples.

5. Explain the role XML namespace with example. (MAY'12)

6. What is meant by DTD? Explain the structure of the DTD.

7. Discuss in detail about XML Schema.

8. Explain in detail about X-Files.

9. Briefly discuss how data types are represented in XML schema. (DEC 2012)

UNIT II

1. Explain about DOM based XML parsing. (NOV 2013)

2. Explain in detail about XSL. (NOV 2013)

3. Explain the following with suitable example. 1. XSL Formatting, 2. Modeling Databases in XML. (MAY 2014).

4. Briefly discuss about XML Transformation and XSL.

5. Briefly discuss about the XML parsing with example.

UNIT III

1. Compare SOA with client-server and distributed internet architectures. . **May/June 2013**

2. Explain in detail about various components of SOA and how they inter relate to each other. .
   May/June 2012

3. Discuss in detail about the Common principles of service- orientation.

4. Discuss in detail about SOA platform basics.

5. Explain the Common Principles of Service Orientation in detail (Nov 2011)

6. Explain common characteristics of contemporary SOA in detail with diagrams.

UNIT IV

1. Write about following:

   a. Write in detail about WSDL with examples.

   b. Write in detail about SOAP with examples. **May/June 2013**

2. Explain in detail about Message Exchange Patterns.

3. Discuss in detail about Orchestration and Choreography. **May/June 2012**

4. Explain about Service Layer Abstraction in detail. . **May/June 2014.**

5. Explain in detail about UDDI.

6. Discuss in detail about WS Transactions.

UNIT V

1. Write in detail bout service oriented analysis.

2. Explain about deriving business modeling

3. Discuss in detail about service modeling.

4. Write in detail about Service Oriented Design. . **May/June 2014**

5. Write in detail about SOAP with examples.

6. Write in detail about Service design

7. Discuss in detail about SOA Support with J2EE and its API's. . **May/June 2013**

8. Discuss in detail about the WS – BPEL with code snippets.

9. Explain about WS-Coordination with code example. **May/June 2013**

10. Explain about WS-Policy with code example. . **May/June 2013**

11. Explain about WS-Security with code example. . **May/June 2013**

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UNIVERSITY QUESTION PAPERS

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 80602

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Seventh Semester

Computer Science and Engineering

IT 6801 — SERVICE ORIENTED ARCHITECTURE

(Regulations 2013)

Time : Three hours　　　　　　　　　　　　Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the rules for well formed documents in XML.

2. What is a XML namespace?

3. Define a XML parser.

4. Write a simple stylesheet using XSL.

5. List out some characteristics of Contemporary SOA.

6. How loose coupling concept achieved in SOA?

7. Sketch the anatomy of a SOAP message.

8. List out some primitive MEPs.

9. Give the step-by-step process in the service oriented analysis.

10. Write the syntax for getVariableData function in WS BPEL.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Create a document type definition that defines the structure for email message, further create a XML document that reference to the created document type definition. (8)

　　　 (ii) With examples explain internal and external DTD. (8)

Or

　　 (b) Explain in detail about the XML schema and XML files. (16)

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12. (a) (i) Differentiate DOM and SAX based XML parsing. (6)

      (ii) Explain SAX based parsing with example. (10)

Or

   (b) (i) Give a brief note on Modeling databases in XML. (8)

      (ii) With example show how XSLT can transform an XML document into HTML. (8)

13. (a) Compare SOA with client-server and distributed internet architectures. (16)

Or

   (b) Summarize the various principles of service orientation in detail. (16)

14. (a) Discuss in detail about Orchestration and Choreography. (16)

Or

   (b) Explain in detail about Atomic Transaction Process with suitable diagrams. (16)

15. (a) Identify the various steps involved in service oriented modeling elaborate them in detail. (16)

Or

   (b) Illustrate in detail about the WS — BPEL with code snippets. (16)

IT6801 SERVICE ORIENTED ARCHITECTURE

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Reg. No. :

Question Paper Code : 72060

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Seventh/Eighth Semester

Information Technology

IT 6801 — SERVICE ORIENTED ARCHITECTURE

(Common to Computer Science and Engineering)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is XML?

2. What are two types of WSDL elements?

3. What is meant by XSL formatting?

4. List out the Characteristics of SOA.

5. What are the benefits of SOA?

6. What do you mean by UDDI?

7. Write about JAX-WS.

8. What is J2EE?

9. What are the Standards that Web service depends on?

10. What do you mean by WS-Security?

PART B — (5 × 16 = 80 marks)

11. (a) Briefly explain the characteristics of Web service framework and web service roles.

Or

(b) Explain the XML document Structure.

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12. (a) Describe in detail about how to create well-formed XML and XSL Transformations.

Or

(b) Describe in detail about the modeling databases in XML.

13. (a) Give an overview of SOA and explain the Characteristics of SOA.

Or

(b) Compare SOA to Client-server and Distributed internet architecture. (16)

14. (a) Briefly explain Messaging with SOAP and service discovery.

Or

(b) Briefly Explain different types of security attacks and Threats and also give the web service security road map.

15. (a) Explain the overview of SOA and the role of web services with .NET and J2EE Interoperability?

Or

(b) Explain the various standards in the development of web services.

B.E/B.TECH DEGREE EXAMINATION APRIL/ MAY 2015

PART A

1. Define SOA

2. What are the coarse grained services?

3. What are web services

4. Compare abstract and concrete descriptions.

5. Get business centric Applications of SOA.

6. Briefly discuss about the operations in entity centric.

7. What is marshalling and un marshalling?

8. What are dynamic proxy and invocation interface?

9. What are ACID transactions?

10. Define WS policy.

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PART B

11.(a)Explain the detail about common principkles of service orientation.

or

(b) Explain in Detail about web services as components wrappers.

12.(a) Discuss in detail about processing of SOAP message.

or

(b) (i) write a detailed note on orchestration and choreography.

(ii) Discuss in detail about application service layer

13.(a) discuss the step by step process of service modeling in detail.

or

(b) Explain the entity centric and task centric business service design in detail.

14.(a) discuss in detail about JAXB architecture.

or

(b) Explain how SOA is achieved in .NET platform.

15.(a) Explain briefly about WS choreography model description

Or

(b) Explain the basics of WS BPEL language detail

B.E/B.TECH DEGREE EXAMINATION NOV/DEC 2014

IT2401-SERVICE ORIENTED ARCHITECTURE

PART A

1. Define application Architecture.

2. List out some common principles of service orientation

3. what is an intermediary service

4. List out the charteristics of ACID transactions

5. what are the types of derived business services?

6. Deffine Envelope element in SOAP message

7. write down the types of components that can be used to build J2EE web Applications.

8. Define Generated stub

9. Differentiate getVariableProperty and getVariableData functions

10. Write any 4 XML signature elements.

PART B

11.(a) Describe how SOA can be compared to distributed internetarchitecure

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or

(b) Discuss the anatomy of service oriented Architecture

12.(a)Write short notes on (i) messaging with SOAP

(ii) Business activities in web services.

or

(b) Briefly explain about:

(i) Service Layer Abstraction.

(ii) Application service layer

13.(a) Explain in detail about service modeling guidelines

or

(b) Describe application service design in a step by step process.

14.(a) Discuss in detail about SOA platform basics.

or

(b) Explain how service oriented architecture is supported in .NET frame work.

15.(a) write short notes ion WS-Coordination overview.

or

(b) Briefly explain about WS-Policy language basics

B.E/B.TECH DEGREE EXAMINATION May/June 2013
PART A

1. what is SOA?

2. Listout the logical components of automation logic.

3. Explain SOAP message format.

4. Differentiate orchestration from Activities.

5. Define service oriented Analysis.

6. What are the potential types of logic suitable for abstract orchectration layer?\

7. List our the common layers required by a development & runtime platform for building SOA?

8. Define service Agent.

9. Distinguish between the identifier and expires elements.

10. What is preference attribute?

PART B

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11.(a) Explain how SOA can be compared to Client server Architecture.

or

(b) Describe the principles of service orientation.

12.(a) write short notes on:

(i) Service Descriptions

(ii) Atomic Transaction.

(iii) Choreography

or

(b) Discuss about different service layer in detail.

13.(a) Briefly explain about WSDL&SOAP basics in service oriented design.

or

(b) Describe in detail about entity centric business service design in astep by step

process.

14.(a) Explain how SOA support in J2EE.

or

(b) Describe how SOA achieved in .NET platform.

15.(a) Discuss WS-BPEL language basis in detail.

or

(b) Explain Ws- security language basics in detail.

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CS6007   **INFORMATION RETRIEVAL**   **L T P C/ 3 0 0 3**

UNIT I   **INTRODUCTION**   9
Introduction -History of IR- Components of IR – Issues –Open source Search engine Frameworks – The impact of the web on IR – The role of artificial intelligence (AI) in IR – IR Versus Web Search – Components of a Search engine- Characterizing the web.

UNIT II   **INFORMATION RETRIEVAL**   9
Boolean and vector-space retrieval models- Term weighting – TF-IDF weighting- cosine similarity – Preprocessing – Inverted indices – efficient processing with sparse vectors – Language Model based IR – Probabilistic IR –Latent Semantic Indexing – Relevance feedback and query expansion.

UNIT III   **WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING**   9
Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement – search engine optimization/spam – Web Search Architectures – crawling – meta-crawlers- Focused Crawling – web indexes –- Near-duplicate detection – Index Compression – XML retrieval.

UNIT IV   **WEB SEARCH – LINK ANALYSIS AND SPECIALIZED SEARCH**   9
Link Analysis –hubs and authorities – Page Rank and HITS algorithms -Searching and Ranking – Relevance Scoring and ranking for Web – Similarity – Hadoop & Map Reduce – Evaluation – Personalized search – Collaborative filtering and content-based recommendation of documents and products – handling "invisible" Web – Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval.

UNIT V   **DOCUMENT TEXT MINING**   9
Information filtering; organization and relevance feedback – Text Mining -Text classification and clustering – Categorization algorithms: naive Bayes; decision trees; and nearest neighbor – Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

TEXT BOOKS: **TOTAL: 45 PERIODS**
1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press, 2008.
2. Ricardo Baeza -Yates and Berthier Ribeiro – Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books 2011.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, 2009.
4. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.

REFERENCES:
1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series ", 2nd Edition, Springer, 2004.
3. Manu Konchady, "Building Search Applications: Lucene, Ling Pipe", and First Edition, Gate Mustru Publishing, 2008.

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UNIT -1 TWO MARKS QUESTION AND ANSWER

Q.1 Deffine information retrieval.

Ans.: Information Retrieval (IR) is finding material (usually documents) of an unstructured nature (usually text) that satisfies an information need from within large collections (usually stored on computers)

Q.2 Explain difference between data retrieval and information retrieval.

Parameters	Data Retrieval	Information Retrieval
Example	Data Base Query	WNW Search
Matching	Exact	Partial Match, Best Match
Inference	Deduction	Induction
Model	Deterministic	probabilistic

Q.3 List and explain components of IR block diagram?

Ans.:

i. **Input:** Store only a representation of the document or query which means that been the text of a document is lost once it has been processed for the purpose of generating its representation.

ii. A **document representative** could be a list of extracted words considered to be significant.

iii. **Processor** Involve in performing actual retrieval function, executing search strategy in response to query.

iv. **Feedback**: improving the subsequent run after sample retrieval.

V. **Output**: A set of document numbers.

Q.4 what is objective term and non-objectives term?

Ans.: Objective terms are extrinsic to semantic content, and there is generally no disagreement about how to assign them. Examples include author name, document URL, and date of publication.

Nonobjective terms are intended to reflect the information manifested in the document, and there is no agreement about the choice or degree of applicability of these terms. They are also known as content terms.

Q.5 Explain the type of natural language technology used in information retrieval.

Ans.: Two types of natural can be used in information retrieval:

1. Natural language interfaces make the task of communicating with the information source easier, allowing a system to respond to a range of input, possibly from inexperienced users, and to produce more customized output.

2. Natural language text processing allows a system to scan the source texts, either to retrieve particular information or to derive knowledge structures that may be used in accessing information from the texts.

Q.6 what is search engine?

Ans.: A search engine is a document retrieval system designed to help find information stored in a computer system, such as on the WWW. The search engine allows one to ask for content meeting specific criteria and retrieves a list of items that match those criteria.

Q.7 what is conflation?

Ans.: Stemming is the process for reducing inflected words to their stem, base or root form, generally a written word form. The process of stemming is often called conflation

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Q.8 what is an invisible web?

Ans.: Many dynamically generated sites are not indexable by search engilles; this phenomenon is known as the invisible web,

Q.9 Define Zipf's law.

Ans.: An empirical rule that describes the frequency of the text words. It states that the ith most frequent word appears as many times as the most frequent one divided by i^{O}, for some $0>1$.

Q.10 what is open source software?

Ans.: open source software is like any other software (closed /proprietary software). This software is differentiating by its use and licenses. Open source software guarantees the right to access and modify the source code, and to use reuses and redistribute the software, all with no royalty or other costs. Open source is an approach to the design, development, and distribution of software, offering practical accessibility to software's source code.

Q.11 what is proprietary software?

Ans.: Proprietary software is computer software which is the legal property of one party. The terms of use for other parties is defined by contracts or licensing agreements. These terms may include various privileges to share, alter, dissemble, and use the software and its code.

Q.12 what is closed software?

Ans.: Closed source is a term for software whose license does not allow for the release or distribution of the software's source code. Generally, it means only the binaries of a computer program are distributed and the license provides no access to the program's source code. The source code of such programs is usually regarded as a I trade secret of the company. Access to source code by third parties commonly requires the party to sign a non-disclosure agreement.

Q.13 List the advantages of open source.

Ans.: Advantages of Open Sources

1. The right to use the software in any way.

2. There is usually no license cost and free of cost.

 3. The source code is open and can be modified freely

4. It is possible to reuse the software in another context or with another public authority.

5. Open Standards 6. It provides higher flexibility.

Q.14 List the disadvantages of open source

Ans.: Disadvantages of Open Sources

1. There is no guarantee that development will happen.

2. It is sometimes difficult to know that a project exist, and its current status' 3. No secured follow-up development strategy

3. No secured follow-up development strategy

Q.15 what are the reasons for selecting open source software?

Ans.: Reasons for choosing open source software

1. Development and maintenance of open source soft-ware is a community based activity.

2. Open source software licenses are copyright protected, they strictly ensure the users freedom to use, modify and distribute the programs.

3. Open source software is interoperable, customizable according to the needs and fulfills the software industry standards.

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4. Open source software allows everyone to use, study, modify and distribute the software.

5. Open source software allows a broader perspective when comes to its support.

Q.16 what do you mean by Apache License?
> **Ans.:**
> • The Apache License is a free software license written by the Apache Software Foundation (ASE). The name Apache is a registered trademark and may only be used with the trademark holder's express permission.
> • Apache license is a high-performance, full-featured text search engine library written entirely in Java. It is a technology suitable for nearly any application that requires full-text search, especially cross-platform.

Q.17 Explain features of GPL version 2.
> **Ans.:** GPL Version 2 Features:
> 1. It gives permission to copy and distribute the program's unmodified source code.
> 2. it allows modifying the program's source code and distributing the modified source code.
> 3. User distributes compiled versions of the program, both modified and unmodified.
> 4. All modified copies are distributed under the GPL v2.
> 5. All compiled versions of the program are accompanied by the relevant source code.

UNIT -2 TWO MARKS QUESTION AND ANSWER

Q.1 what do you mean by Information Retrieval Models?
> **Ans. :** Are model can be a description of either the computational process or the human process of retrieval The process of choosing documents for retrieval; the process by which information needs are first articulated and then refined.

Q.2 what is cosine similarity?
> **Ans.:** This metric is frequently used when trying to determine similarity between two documents. Since there are more words that are common between two documents, it is useless to use the other methods of calculating similarities.

Q.3 what is language model used IR?
> **Ans.:** A language model is a probabilistic mechanism for generating text. Language models estimate the probability distribution of various natural language phenomena.

Q.4 Define unigram language
> **Ans.:** A mailgram (1-gram) language model makes the strong independence assumption that words are generated independently from a multinomial distribution 0.

Q.5 what are the characteristics of relevance feedback
> **Ans.:** Characteristics of relevance feedback:
> 1. It shields the user from the details of the query reformulation process.
> 2. It breaks down the whole searching task into a sequence of small steps which are easier to grasp.
> 3. Provide a controlled process designed to emphasize some terms (relevant ones) and de-emphasize others (non-relevant ones)

Q.6 what are the assumesion of vector space model?
> **Ans.:** Assumesion of vector space model:
> 1. The degree of matching can be used to rank-order documents;
> 2. This rank-ordering corresponds to how well a document satisfying a user's information needs.

Q.7 what are the disadvantages of Boolean model?

Ans.: Disadvantages

a.   It is not simple to translate an information need into a Boolean expression.
b.   Exact matching may lead to retrieval of too few or too many documents.
c.   The retrieved documents are not ranked.
d.   The model does not use term weights.

Q.8 Define term frequency.

Ans.: Term frequency (TF): Frequency of occurrence of query keyword in document

Q.9 Explain Luhn's Ideas

Ans.: Luin's basic idea to use various properties of texts, including statistical ones, was critical in opening handling of input by computers for IR. Automatic input joined the already automated output.

Q.10 Define stemming

Ans.: Conflation algorithms are used in information retrieval systems for matching the morphological variants of terms for efficient indexing and faster retrieval operations. The conflation process can be done either manually or automatically. The automatic conflation operation is also called stemming.

Q.11 what is Recall?

Ans.: Recall is the ratio of the number of relevant number of relevant documents retrieved to the total number of relevant documents in the collection.

Q.12 what is precision?

Ans.: Precision is the ratio of the number of relevant document retrieved to the total number of documents retrieved.

Q.13 Explain Latent Semantic Indexing

Ans.: Latent Semantic Indexing is a technique that projects queries and documents in to a space with "latent" semantic dimensions. It is statistical method for automatic major problems of the current technology and retrieval that attempts to solve the major problems of the current technology. It is intended to uncover latent semantic structure in the data that is hidden. It creates a semantic space wherein terms and documents that are associated are placed near one another.

UNIT -3 TWO MARKS QUESTION AND ANSWER

Q.1 Define web server.

Ans.: A web server is a computer connected to the Internet that runs a program that takes responsibility for storing, retrieving and distributing some of the web files.

Q.2 what is Web Browsers?

Ans.: A web browser is a program. Web browser is used to communicate with web servers on the Internet, which enables it to download and display the web pages. Netscape Navigator and Microsoft Internet Explorer are the most popular browser software's available in market.

Q.3 Explain paid submission of search services.

Ans.: In paid submission, user submit website for review by a search service for a preset fee with the expectation that the site will be accepted and included in that company's search engine, provided it meets the stated guidelines for submission. Yahoo! is the major search engine that accepts this type of submission, while paid submissions guarantee a timely review of the submitted site and notice of acceptance or rejection, you're not guaranteed inclusion or a particular placement order in the listings.

Q.4 Explain paid inclusion programs of search services.

Ans.: Paid inclusion programs allow you to submit your website for guaranteed Inclusion in a search engine's database of listings for a set period of time. While paid

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inclusion guarantees indexing of submitted pages or sites in a search database, you're not guaranteed that the pages will rank well for particular queries.

Q.5 Explain in pay-for-placement of search services.

Ans.: pay-for-placement, you can guarantee a ranking in a search listing for the terms of your choice. Also known as paid placement, paid listings, or sponsored listings, this program guarantees placement in search results. The leaders in pay-for-placement are Google, Yahoo! and Bing.

Q.6 Define Search engine optimization.

Ans.: Search engine optimization (SE0) is the act of modifying a website to increase its ranking in organic (vs paid), crawler-based listings of search engines. There are several ways to increase the visibility of your website through the major search engines on the Internet today. The two most common forms of Internet marketing Paid (Sponsored) Placement and Natural Placement

Q.7 Describe benefit of SEO.

Ans. : Benefit of SEO:

1. Increase your search engine visibility
2. Generate more traffic from the major search engines
3. Make sure your website and business get NOTICED and VISITED
4. Grow your client base and increase business revenue

Q.8 Explain the difference between SEO and Pay-Per-Click

Ans.:

SEO	Pay-Per-Click
SEO results take 2 weeks to 4 months	It results in 1-2 days
it is very difficult to control flow of traffic	It has ability to turn on and off at any movement.
Requires ongoing learning and experience to reap results	Easier for a novice
It is more difficult to target local markets	Ability to target local" markets
Better for long-term and lower margin campaigns	Better for short-term and high-margin campaigns
Generally more cost-effective, doesn't penalize for more traffic	Generally more costly per visitor and per conversion

Q.9 what is web crawler?

Ans.: A web crawler (also known as a web spider) is a program which browses the World Wide Web in a methodical, automated manner. Web crawlers are mainly used to create a copy of all the visited pages for later processing by a search engine that will index the downloaded pages to provide fast searches.

Q.10 Define focused crawler.

Ans.: A focused crawler or topical crawler is a web crawler that attempts to download only, web pages that are relevant to a press-defined topic or set of topics.

Q.11What is hard and soft focused crawling?

Ans.: In **hard focused crawling**, the classifier is invoked on a newly crawled document in a standard manner. When it returns the best matching category path, the

out-neighbors of the page are checked into the database if and only if some node on the best matching category path is marked as good.

In **soft focused crawling**, all outs-neighbors of a visited page are checked into DB2, but their crawl priority is based on the relevance of the current page.

Q.12 what are the Near-duplicate detection?

Ans.: Near-duplicate detection is the task of identifying documents with almost identical content. Near-duplicate web documents are abundant. Two such documents differ from each other in a very small portion that displays advertisements, for example. Such differences are irrelevant ant for web search.

Q.13 what are requirements of XML information retrieval systems?

Ans.: Requirements of XML information retrieval systems:

1. Query languages that allow users to specify the nature of relevant components, in particular with respect to their structure.
2. Representation strategies providing a description not only of the content of XML documents, but also their structure.
3. Ranking strategies that determine the most relevant elements and rank these appropriately for a given query.

UNIT -4 TWO MARKS QUESTION AND ANSWER

Q.1 what is link analysis?

Ans.: The goal of inform retrieval is to find all documents relevant for a user query in a collection of documents. With the advent of the web new sources of information became available, one of them being the hyperlinks between documents and records of user behavior. Collections of documents connected by hyperlinks Hyperlinks provide a valuable source of information for web information retrieval. This' area of information retrieval is commonly called **link analysis.**

Q.2 what is in query independent ranking?

Ans.: In **query-independent ranking** a score is assigned to each page without a specific user query with the goal of measuring the intrinsic quality of a page. At query time this score is used with or without some query-dependent criteria to rank all documents matching the query.

Q.3 what is in query dependent ranking?

Ans.: In query-dependent ranking a score measuring the quality and the relevance of a page to a given user query is assigned to some of the pages.

Q.4 Define authorities

Ans.: Authorities are pages that are recognized as providing significant, trustworthy, and useful information on a topic. In-degree (number of pointers to a page) is one simple measure of authority. However in-degree treats all links as equal.

Q.5 Define hubs

Ans.: Hubs are index pages that provide lots of useful links to relevant content pages (topic authorities). Hub pages for IR are in the home page.

Q.6 what is Hadoop?

Ans.: At Google MapReduce operation are run on a special file system called Googlee File System (GFS) that is highly optimized for this purpose. GFS is not open source. Doug Cutting and Yahoo! reverse engineered the GFS and called it Hadoop Distributed File System (HDFS). The software framework that supports HDFS, MapReduce and other related entities is called the project Hadoop or simply **Hadoop**

Q.7 what are the Hadoop Distributed File System?

Ans.: The Hadoop Distributed File System (HDFS) is designed to store very large data sets reliably, and to stream those data sets at high bandwidth to user application HDFS stores file system metadata and application data separately. The HDFS Namespace is a hierarchy of files and directories. Files and directories are represented on the NameNode by inodes, which record attributes like permissions, modification and disk space quotas.

Q.8 Define MapReduce.

Ans.: MapReducee is a programming model and software framework first developed by Google. Intended to facilitate and simplify the processing of vast amounts of data in hardware in parallel on large clusters of commodity hardware in a reliable, fault-tolerant manner.

Q.9 List the characteristics of MapReduce?

Ans.: Characteristics of MapReduce

1. Very large scale data: peta, exa bytes
2. Write once and read many data. It allows for Parallelism without mutexes
3. Map and Reduce are the main operations: simple code
4. All the map should be completed before reduce operation starts.
5. Map and reduce operations are typically performed by the same physical processor.
6. Number of map tasks and reduce tasks are configurable.
7. Operations are provisioned near the data.
8. Commodity hardware and storage.

Q. 10 what are the limitation of Hadoop/MapReduce?

Ans.: Limitation of Hadoop/MapReduce

1. Cannot control the order in which the maps or reductions are run.
2. For maximum parallelism, you need Maps and Reduces to not depend on data generated in the same MapReduce job (i.e. stateless).
3. A database with an index will always be faster than a MapReduce job on unindexed data.
4. Reduce operations do not take place until all Maps are complete.
5. General assumption that the output of Reduce is smaller than the input to Map; large data source used to generate smaller final values.

Q.11 what is Cross-Lingual Retrieval?

Ans.: Cross-Lingual Retrieval refers to the retrieval of documents that are in a language different from the one in which the query is expressed. This allows users to search document collections in multiple languages and retrieve relevant information in a form that is useful to them, even when they have little or no linguistic competence in the target languages.

Q.12 Define snippets

Ans.: Snippets are short fragments of text extracted from the document content or its metadata. They may be static or query based. In static snippet, it always shows the first 50 words of the document, or the content of its description metadata, or a description taken from a directory site such as draoz.org. A query based snippet is one selectively extracted on the basis of its relation to the searcher's query.

Q.13 list advantages of invisible web content

Ans.: Advantages of invisible web content

1. Specialized content focus - large amounts of information focused on an exact subject

2. Contains information that might not be available on the visible web

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3. Allows a user to find a precise answer to a specific question 4. Allows a user to find WebPages from a specific date or time

Q.14 what is collaborative filtering?

Ans.: Collaborative filtering is a method of making automatic predictions (filtering) about the interests of a single user by collecting preferences or taste information from many users (collaborating). It uses given rating data by many users for many items as the basis for predicting missing ratings and/or for creating a top-N recommendation List for a given user, called the active user.

Q.15 What do you mean by item based collaborative filtering ?

Ans.: Item based CF is a model-based approach which Produces recommendations based on the relationship between items inferred from the rating matrix. The assumption behind this approach is that users will prefer items that are similar to other items they like.

Q.16 what are problem of user based CF?

Ans.: The two main problems of user-based CF are that the whole user database has to be kept in memory and that expensive similarity computation between the active user and all other users in the database has to be performed.

Q.17 Define User based collaborative filtering

Ans.: User -based collaborative filtering algorithms work off the premise that if a user, (A) has a similar profile to another user (B) then A is more likely to prefer things that B prefers compared with a user chosen at random.

UNIT -5 TWO MARKS QUESTION AND ANSWER

Q.1 what do you mean by information filtering?

Ans.: An Information filtering system is a system that removes redundant or unwanted information from an information stream using (semi)automated or computerized methods prior to presentation to a human user. Its main goal is the management of the information overload and increment of the semantic signal-to-noise ratio.

Q.2 what are the characteristics of information filtering?

Ans.: 1. Filtering systems involve large amounts of data.
2. Information filtering systems deal with textual information.
3. It is applicable for unstructured or semi-structured data.

Q.3 Explain difference between Information Filtering and Information Retrieval

Ans.:

Information Filter	Information Retrieval
IF is concerned with the removal of textual information from an incoming stream and its dissemination to groups or individuals.	IR systems are concerned with the collection and organization of texts so that users can then easily find a text in the collection.
Information filtering is concerned with repeated uses of the systems by users with long-term, but changing interest and needs.	A query represents a one-time information need.
Filtering is based on descriptions of individual or group interests or needs that are usually called Profiles.	Retrieval of infortnation is instead based on user specified information needs in the form of a query.
IF systems are designed for long term users with long term information needs, and for repetitive usage.	IR systems are designed for ad-hoc use-- of a one-time user, to fulfill a one-time information need

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IF systems deal with dynamic data	IR systems deal with static databases

Q.4 what is text mining?

Ans.: Text Mining is understood as a process of automatically extracting meaningful, useful, previously unknown and ultimately comprehensible information from textual document repositories. Text mining can be visualized as consisting of two phases: Text refining that transforms free-form text documents into a chosen intermediate form, and knowledge distillation that deduces patterns or knowledge from the intermediate form.

Q.5 what is classification?

Ans.: Classification is a technique used to predict group membership for data instances. For example, you may wish to use classification to predict whether the weather on a particular day will be "sunny", "rainy" or "cloudy".

Q.6 Explain clustering

Ans.: Clustering is a process of partitioning a set of data in a set of meaningful subclasses. Every data in the subclass shares a common trait. it helps a user to understand the natural grouping or structure in a data set.

Q.7 what are the desirable properties of a Clustering Algorithm?

Ans.: 1. Scalability (in terms of both time and space)
    2. Ability to deal with different data types
    3. Minimal requirements for domain knowledge to determine input parameters
    4. Interpretability and usability

Q.8 what is decision tree?

Ans.: A decision tree is a simple representation for classifying examples. Decision tree teaming is one of the most successful techniques for supervised classification learning. A decision tree or a classification tree is a tree in which each internal (non-leaf) node is labeled with an input feature. The arcs coming from a node labeled with a feature are labeled with each of the possible values of the feature. Each leaf of the tree is labeled with a class or a probability distribution over the classes.

Q.9 List the advantages of decision tree.

Ans.: Advantages of decision tree:

1. Decision trees can handle both nominal arid numeric input attributes.

2. Decision tree representation is rich enough to represent any discrete value classifier.

3. Decision trees are capable of handling datasets that may have errors.

4. Decision trees are capable of handling datasets that may have missing values.

5. It is self-explanatory and when compacted they are also easy to follow.

Q.10 List the disadvantages of decision tree.

Ans.: Disadvantages

1. Most of the algorithms require that the target at-tribute will have only discrete values.

2. Most decision-free algorithms only examine a single field at a time.

3. Decision trees are prone to errors in classification problems with many classes.

4. As decision trees use the "divide and conquer" method, they tend to perform well if a few highly relevant attributes exist, but less so if many complex interactions are present.

Q.11 what is supervised learning?

Ans.: In supervised learning, both the inputs and the outputs are provided. The network then processes the inputs and compares its resulting outputs against the

desired outputs. Errors are then propagated back through the system, causing the system to adjust the weights which control the network

Q.12 what is unsupervised learning?

Ans.: In an unsupervised learning, the network adapts purely in response to its inputs. Such networks can learn to pick out structure in their input.

Q.13 what is dendrogram?

Ans.: Decompose data objects into a several levels of nested partitioning (tree of clusters), called a dendrogram. A Clustering of the data objects is obtained by cutting the dendrogram at the desired level, then each connected component forms a cluster.

PART – B (16 MARKS QUESTIONS)

UNIT – 1

Q.1 characterizing the web in detail.

Q.2 Comparison of open source software with closed source software

Q.3 Explain difference between data retrieval and information retrieval

Q.4 Explain the components of search engine and the components of IR.

Q.5 List the impact of web on IR and the role of AI in IR.

UNIT – 2

Q.1 Explain Relevance Feedback and Query Expansion

Q.2 Explain latent semantic in detail

Q.3 Explain the information retrieval model

Q.4 Explain language model based IR and probabilistic IR

Q.5 Explain the term weighting in detail

UNIT – 3

Q.1 Explain the web structure

Q.2 Explain web crawlers and meta-searches

Q.3 Explain focused crawling

Q.4 Explain XML retrieval in detail

Q.5 Explain search engine optimization/spam

Q.6 Explain near duplicate detection and index compression

UNIT – 4

Q.1 State the link analysis

Q.2 Explain the page rank and HITS algorthim

Q.3 Explain Hadoop & Mapreuduce

Q.4 Handling the invisible web in detail

Q.4 Snippet generation in detail

Q.5 Cross-lingual retrieval in detail

Q.6 Explain evaluation and collaborative filtering

Q.7 Explain the content based recommendation and documents and products

UNIT – 5

Q.1 Explain K-means Clustering vs Hierarchical clustering

Q.2 Explain web data mining and information filtering

Q.3 Explain text mining vs text classification and clustering

Q.4 Explain Expectation maximization algorithm

Q.5 Explain Categorization algorithm in detail

Q.6 Explain the Nearest neighbors with example

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

UNIVERSITY QUESTION PAPER

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Seventh Semester

Computer Science and Engineering

CS 6007 – INFORMATION RETRIEVAL

(Regulations 2013)

Time : Three hours   Maximum : 100 r

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Information Retrieval?

2. Specify the role of an IR system.

3. List the retrieval models.

4. Define Document Preprocessing

5. What is the purpose of web crawler?

6. What are the requirements of XML information retrieval systems?

7. Define authorities.

8. Define user based collaborative Filtering.

9. What are the characteristics of information filtering?

10. What are the desirable properties of a clustering algorithm?

PART B — (5 × 16 = 80 marks)

11. (a) Explain in detail about the components of IR.

Or

(b) Write a short note on
     (i) Characterizing the web for search.
     (ii) Role of AI in IR.

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12. (a) Briefly explain weighting and cosine similarity.

Or

(b) Write about relevance feedback and query expansion.

13. (a) Elaborate on the web search architectures.

Or

(b) Describe meta and focused crawling.

14. (a) Compare HITS with Page rank in detail.

Or

(b) Explain in detail cross lingual information retrieval and its limitations in web search.

15. (a) Discuss in detail about the working of Naïve Bayesian classifier with an example.

Or

(b) Give an account of the Expectation Maximization problem.

CS6007 INFORMATION RETRIEVAL